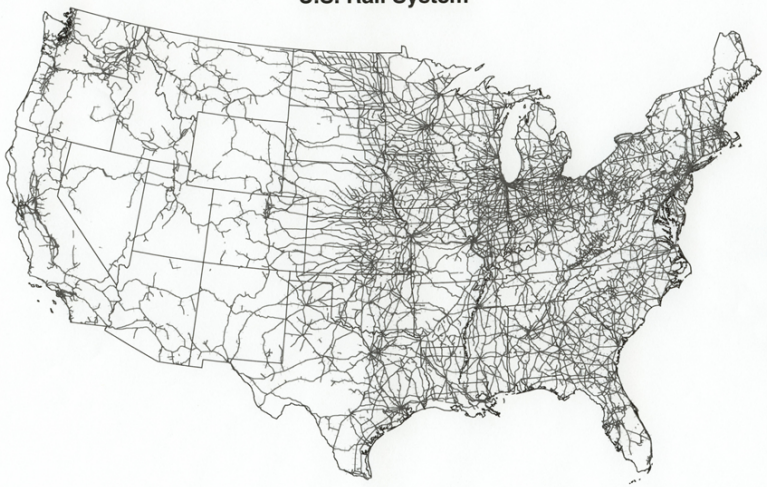
Agricultural Transportation

An Overview

2004

AMS Transportation and Marketing Programs
Transportation Services Branch

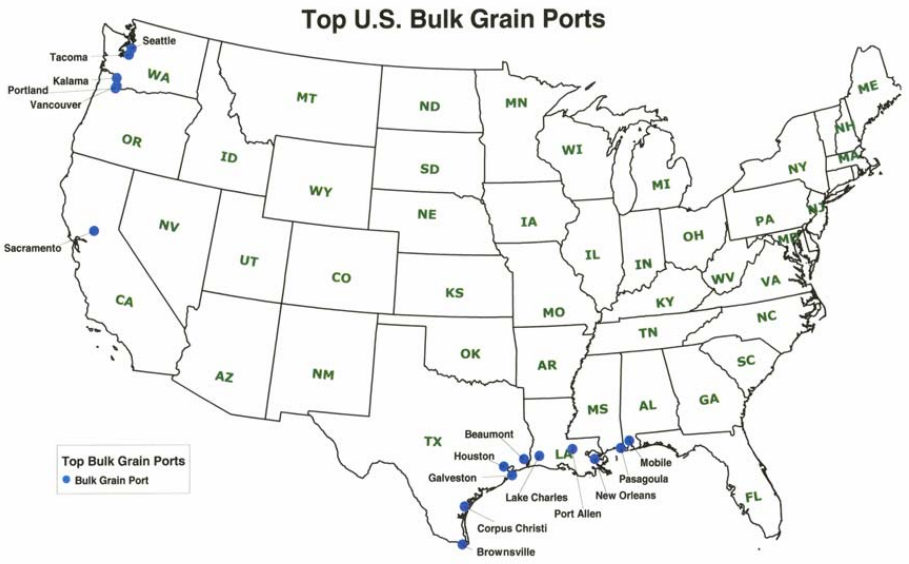
U.S. Rail System



U.S. Interstate Highway System

Agriculturally Significant Waterways

Top U.S. Bulk Grain Ports



Compare...

Iowa Department of Transportation

Source: Iowa Department of Transportation - 800 Lincoln Way - Ames, IA 50010 - 515-239-1372

Cargo Capacity

ONE BARGE
1,500 TON
52,500 BUSHELS
453,600 GALLONS

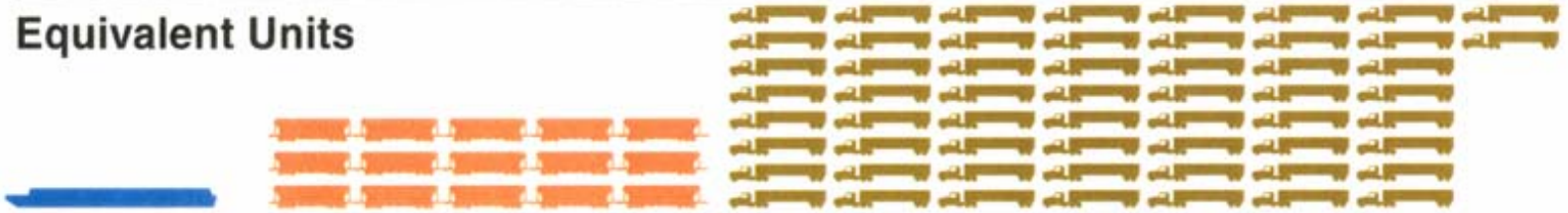
ONE 15 BARGE TOW
22,500 TON
787,500 BUSHELS
6,804,000 GALLONS

JUMBO HOPPER CAR
100 TON
3,500 BUSHELS
30,240 GALLONS

100 CAR TRAIN
10,000 TON
350,000 BUSHELS
3,024,000 GALLONS

LARGE SEMI
26 TON
910 BUSHELS
7,865 GALLONS

Equivalent Units



ONE BARGE

15 JUMBO HOPPER CARS

58 LARGE SEMIS

ONE 15 BARGE TOW

2.25 100 CAR TRAIN

870 LARGE SEMIS

Equivalent Lengths

ONE 15 BARGE TOW

.25 MILE

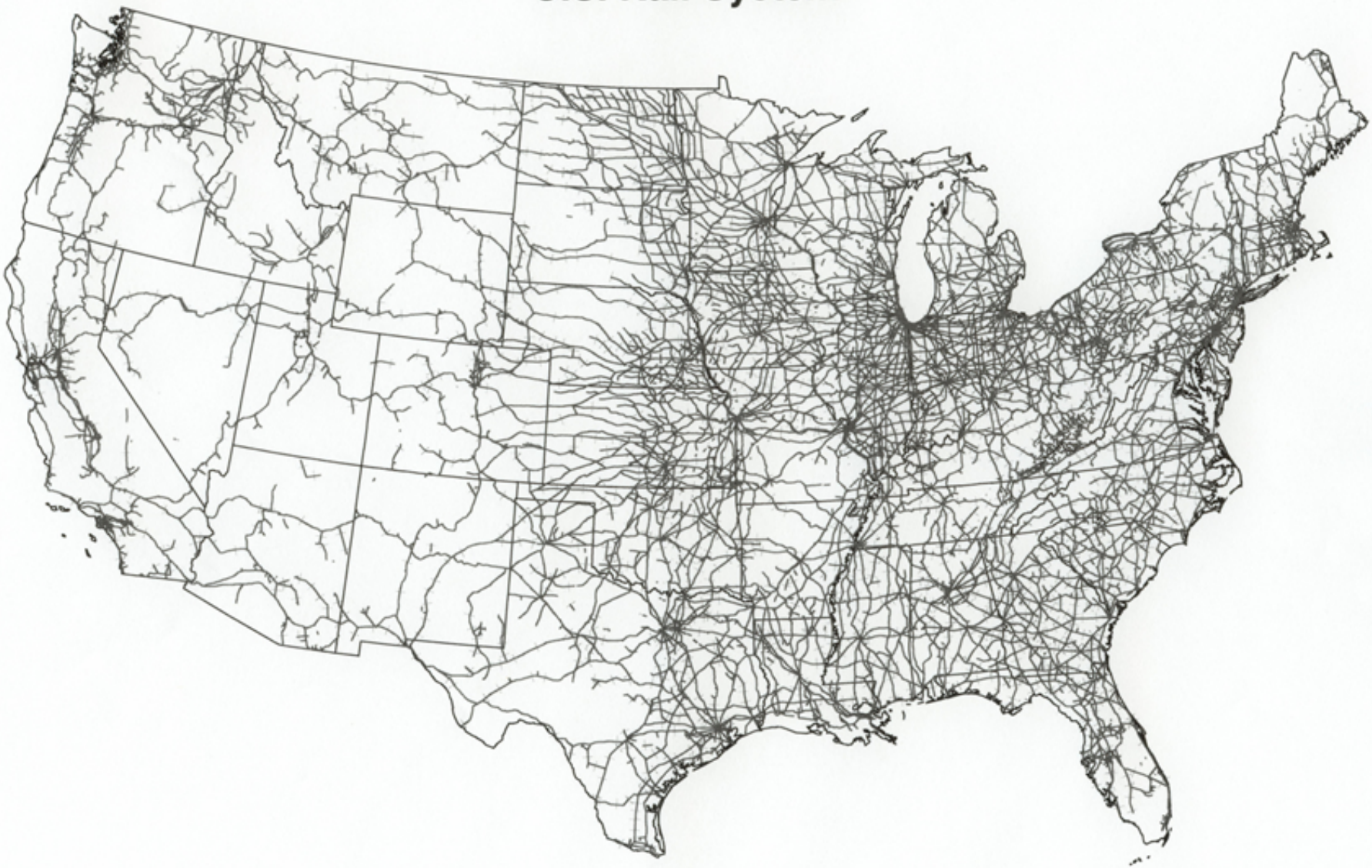
2.25 100 CAR TRAIN

2.75 MILES

870 LARGE SEMIS

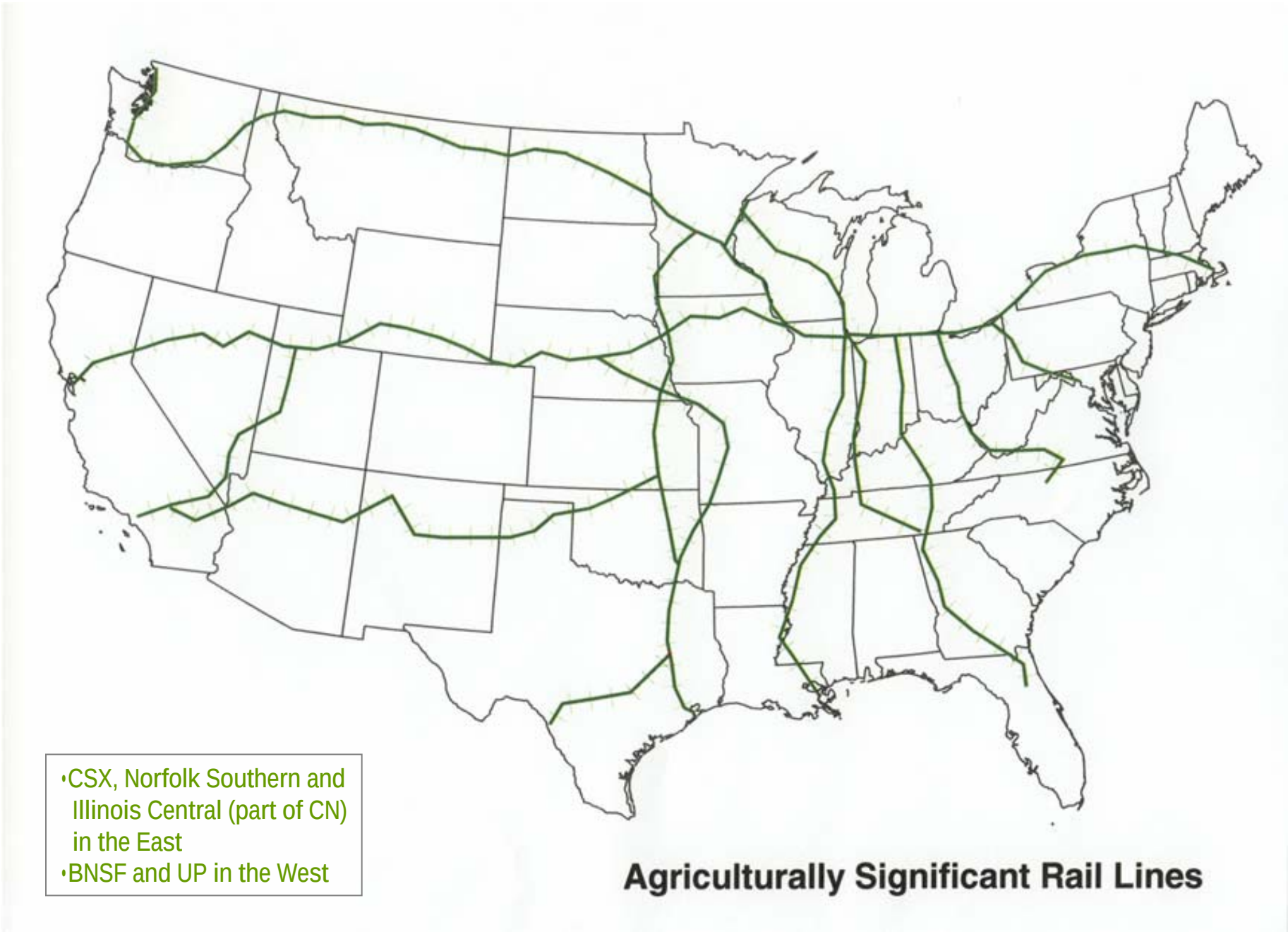
11.5 MILES
(BUMPER TO BUMPER)

U.S. Rail System



U.S. Rail System

- More than 143,000 rail miles.
- 7 Class 1 railroads (98,000 miles or 68% of total):
  - Burlington Northern Santa Fe (BNSF)
  - Canadian National (CN)
  - Canadian Pacific (CP)
  - CSX
  - Kansas City Southern
  - Norfolk Southern
  - Union Pacific (UP)
- 34 regional railroads (20,900 miles).
- 314 linehaul railroads (6,700 miles).


•CSX, Norfolk Southern and Illinois Central (part of CN) in the East
•BNSF and UP in the West
Agriculturally Significant Rail Lines

Agricultural-Related Rail Shipments Exceed 450 Million Tons in 2001

- Total rail shipments in 2001: 2.184 billion tons.
- Agricultural shipments around 20%.
- Farm products: 160 million tons (98% field crops).
- Processed food: 124 million tons.
- Lumber/wood: 76 million tons.
- Paper/pulp: 68 million tons.
- Agri-chemicals: 25 million tons.

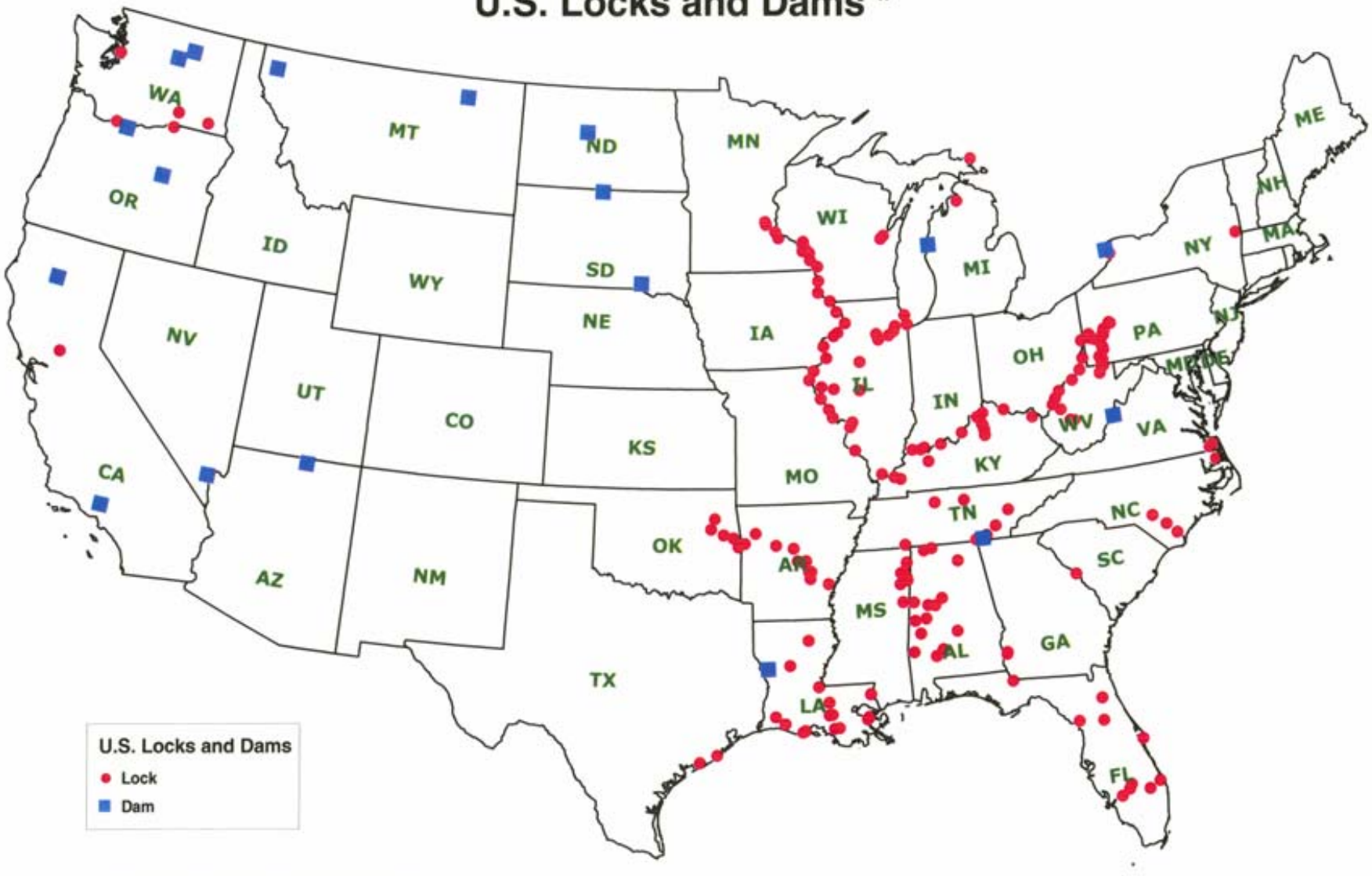
- Mississippi River & Tributaries in the Midwest
- Columbia & Snake Rivers in the West

Agriculturally Significant Waterways

U.S. Waterways Carry Nation's Grain

- **Nearly 12,000 miles of commercially navigable inland and intracoastal waterways.**
- **Army Corps of Engineers operates & maintains.**
- **In 2002, 62% of grain exports left from Louisiana ports.**
- **Louisiana ports receive 90% of exports by barge.**
- **Mississippi River port system world's largest in tonnage: 462 million tons in 2002.**
- **Port of South Louisiana busiest in U.S., 3^{d} busiest in world with 260 million tons.**
- **11% of grain exports from Pacific Northwest via Columbia River.**

U.S. Locks and Dams *



* Top 18 dams by capacity and reservoir size

U.S. Dam Facts

- 77,000 dams in National Inventory of Dams.
- 10,000 in “high-hazard” category (failure means loss of life or significant property loss).
- Bureau of Reclamation operates 3 most important dams: (importance based on flood control, irrigation, power generation).
  - Grand Coulee (on Columbia River)
  - Shasta (on Sacramento River)
  - Hoover (on Colorado River)
- Average age of dam in U.S., 40 years.
- 81% are earthen.
- Texas has most dams: 6,342.

U.S. Interstate Highway System

Ag Products Move by Truck

- **Entire U.S. road system: 5.4 million miles:**
  - **2.2 million paved miles.**
  - **45,500 miles of interstate highways.**
- **Grain: Truck replaced rail as predominant grain-hauling mode around 1985.**
- **Produce: Trucks haul about 90% of refrigerated perishables.**
- **6 key domestic distribution markets:**
  - **Atlanta**
  - **Chicago**
  - **Dallas**
  - **Denver**
  - **Los Angeles**
  - **New York**

Top U.S. Container Ports for Agricultural Exports

Ag Trade Depends on Container Shipments

Exports

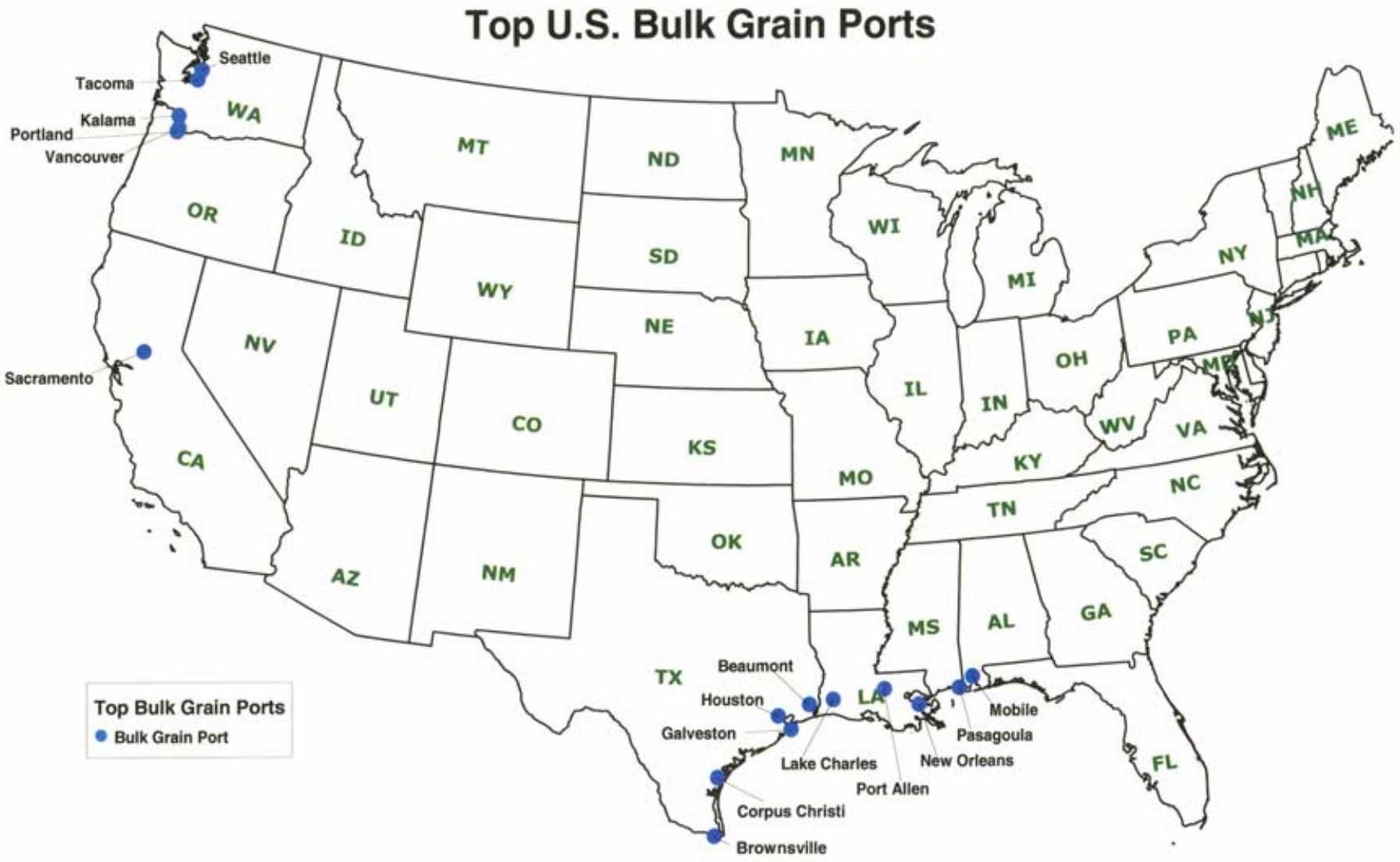
- **Nearly 50% of U.S. ag trade is shipped by container.**
- **1.1 million containers of ag product exported in 2001.**
- **9% of containers held grain/grain products (animal feed).**
- **42% of ag exports in temp-controlled containers.**

Top 5 ag products exported in containers: **animal feed & hay, prepared goods, cotton, meat/poultry, fruits & vegetables.**

Imports

- **731,000 containers of ag product imported in 2001.**

Top 5 ag products imported in containers: **bananas, coffee, fruits & vegetables, wine, breads/cereals.**


Top U.S. Bulk Grain Ports
Seattle
Tacoma
Kalama
Portland
Vancouver
Sacramento
Beaumont
Houston
Galveston
Lake Charles
Port Allen
New Orleans
Pasagoula
Mobile
Corpus Christi
Brownsville
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
NJ
CT
RI
MA
NH
ME
Top Bulk Grain Ports
Bulk Grain Port

Most Grain Ships in Bulk

- 69% of bulk grain is exported from Gulf (Mississippi River ports & Houston).
- 80-90% grain delivered to Mississippi River ports by barge.
- Nearly all grain delivered to Texas ports by rail.
- 17% bulk grain exported from Pacific Northwest.
- Grain delivered to Pacific Northwest ports by rail or by barge on Columbia River system.

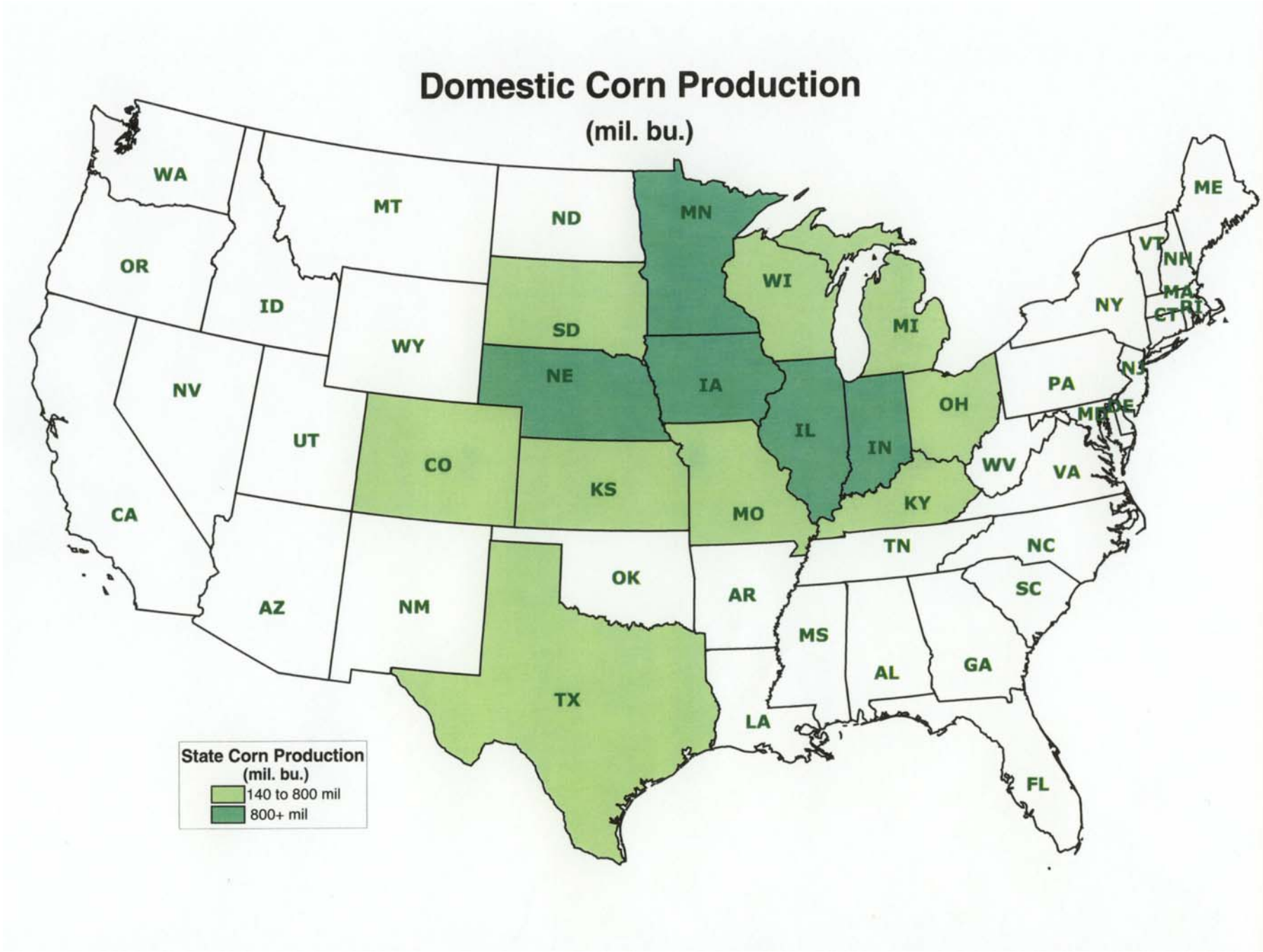
Grain Transportation

The following slides show production, consumption, and surplus/deficit maps for corn, wheat, and soybeans.

Maps also show by what mode of transportation the commodities move.

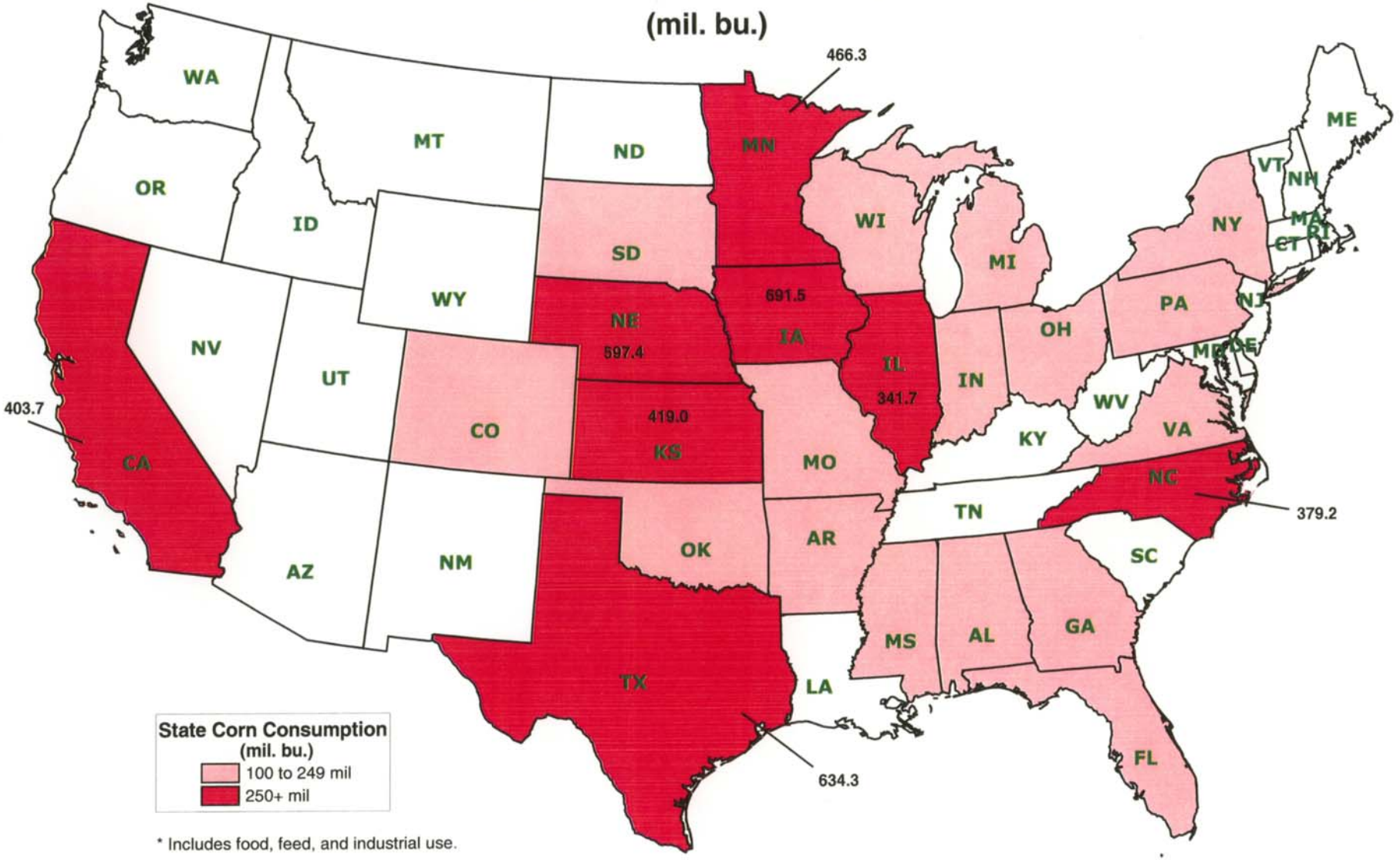
Corn Facts

- In 2001, The U.S. produced 9.5 billion bushels of corn.
- Most corn ends up as feed, so much stays in the Midwest or is shipped to Texas, California, and North Carolina.
- Of the remaining corn, 32% (627 mil bu) goes for ethanol, and 27% (537 mil bu) goes for high fructose corn syrup. Starch follows at 13%, glucose/dextrose at 11%, cereal at 9%, beverages/industrial at 7%, and seed at 1% (2001).
- 80-90% of corn exported from Mississippi River ports moves by barge from the Midwest.
- Corn moves by rail to the West and Southeast.


Domestic Corn Production
(mil. bu.)
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DE
NJ
CT
RI
MA
VT
NH
ME
State Corn Production
(mil. bu.)
140 to 800 mil
800+ mil

Domestic Corn Consumption*

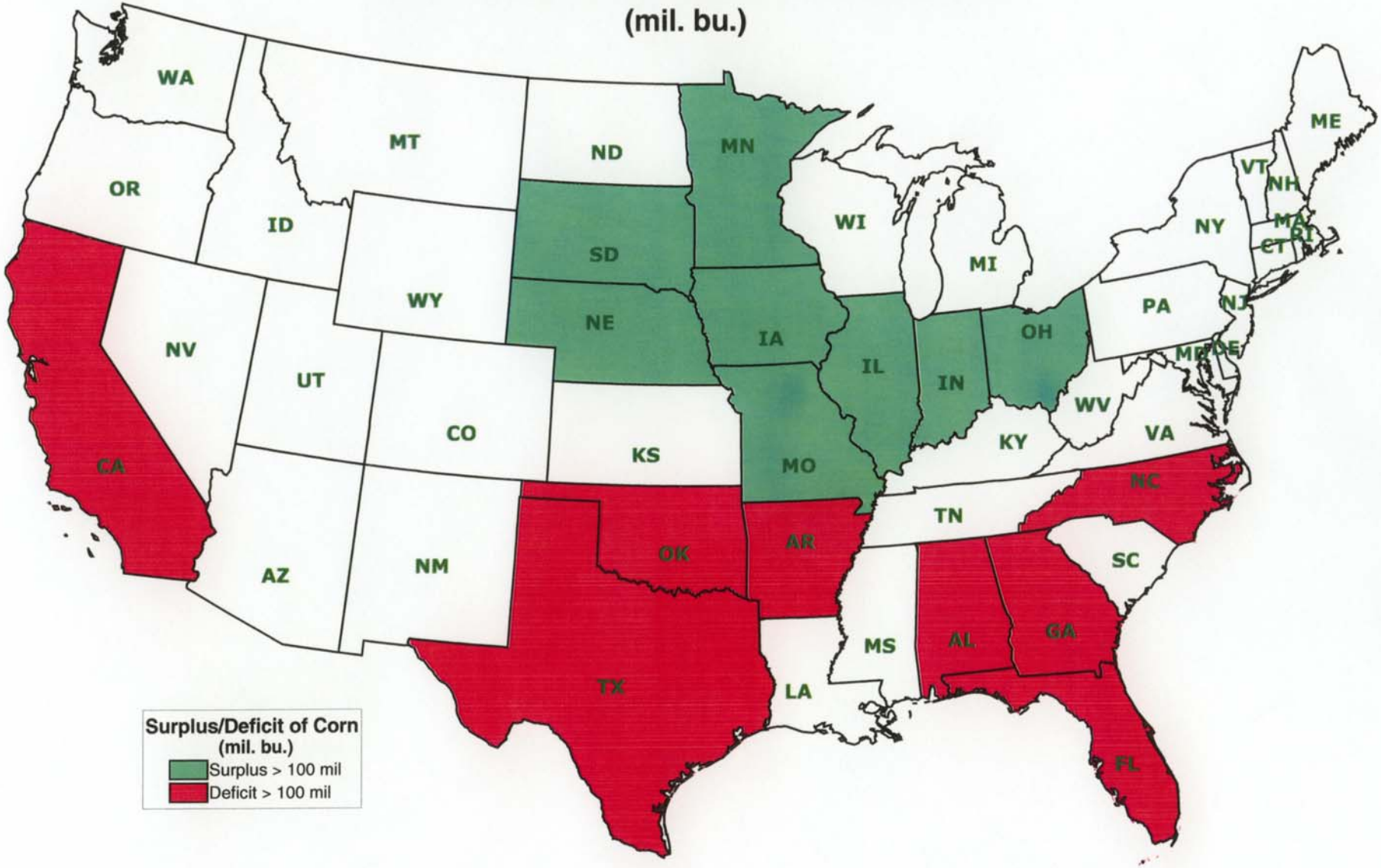
(mil. bu.)

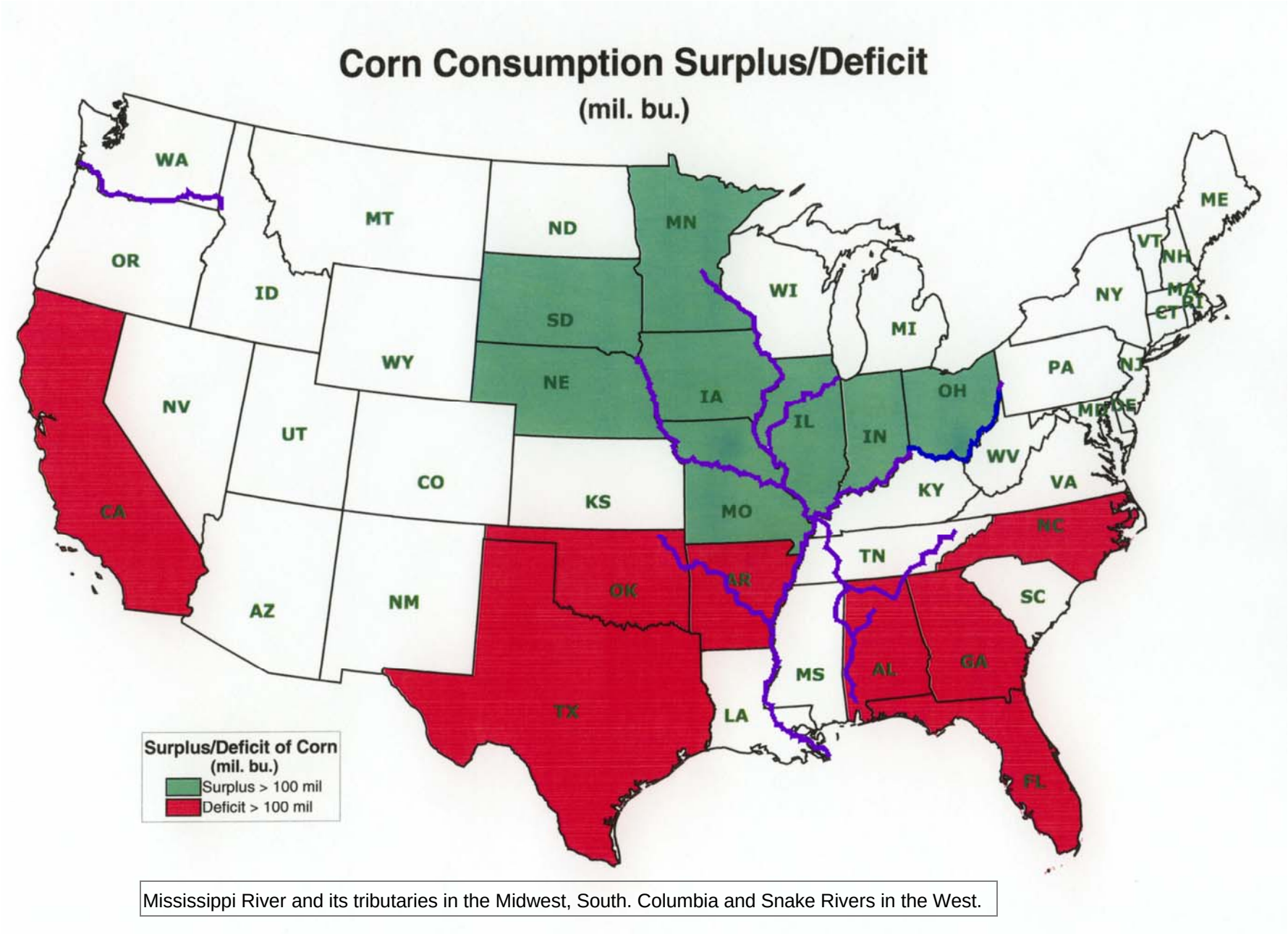


* Includes food, feed, and industrial use.

Corn Consumption Surplus/Deficit

(mil. bu.)

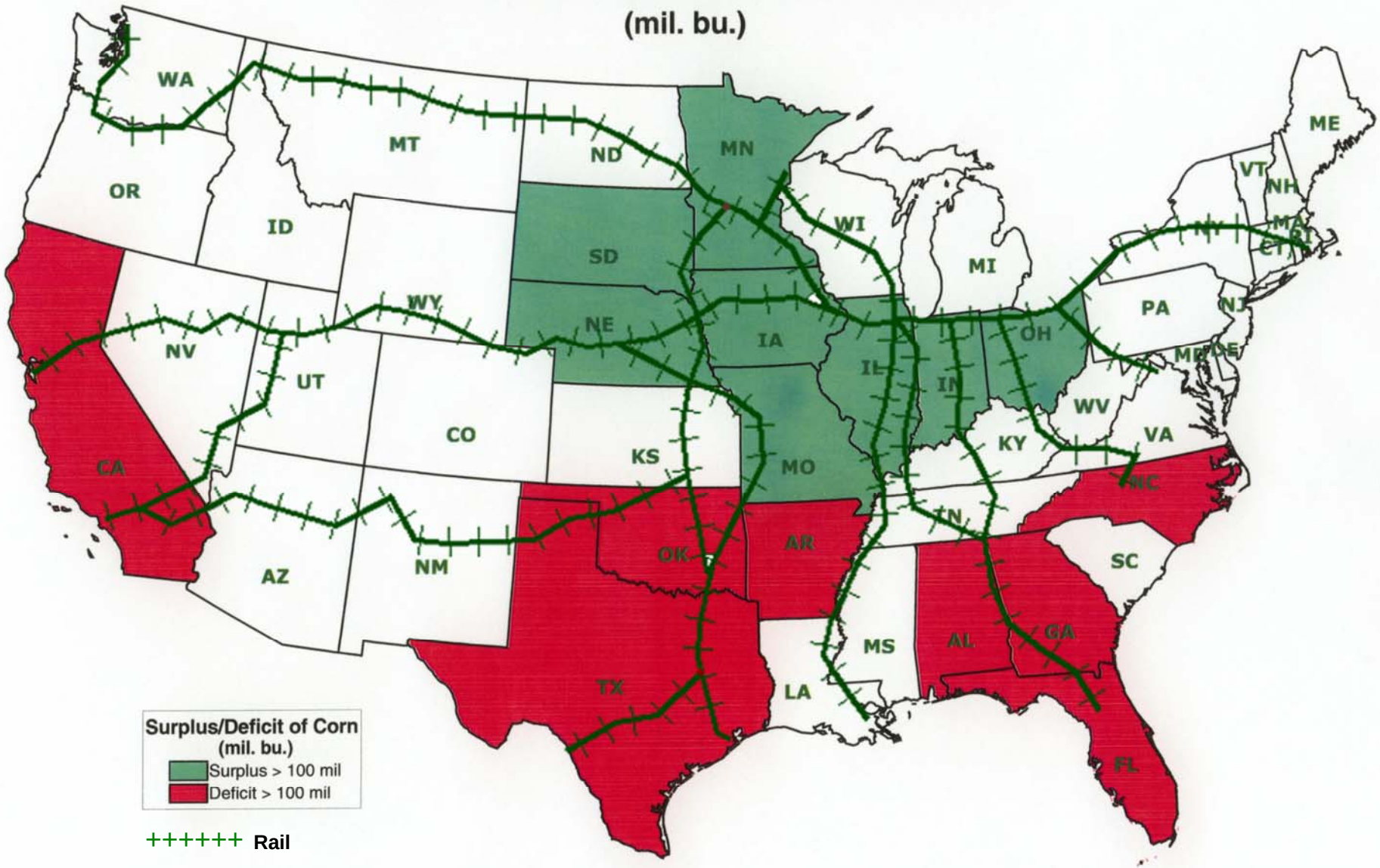




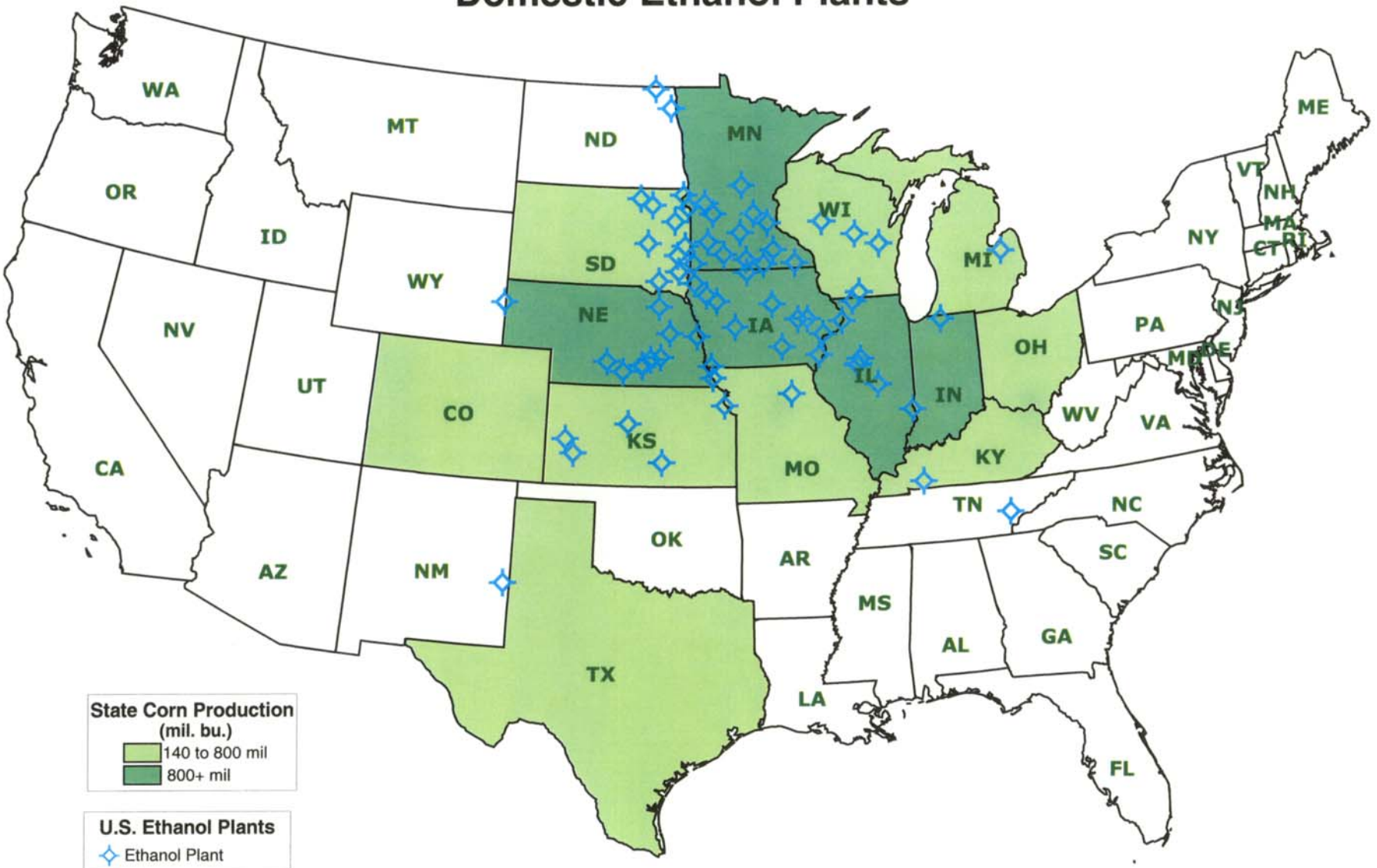
Mississippi River and its tributaries in the Midwest, South. Columbia and Snake Rivers in the West.

Corn Consumption Surplus/Deficit

(mil. bu.)



Domestic Ethanol Plants



Ethanol Production

Definition: an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars.

Feedstocks: corn, barley, wheat.

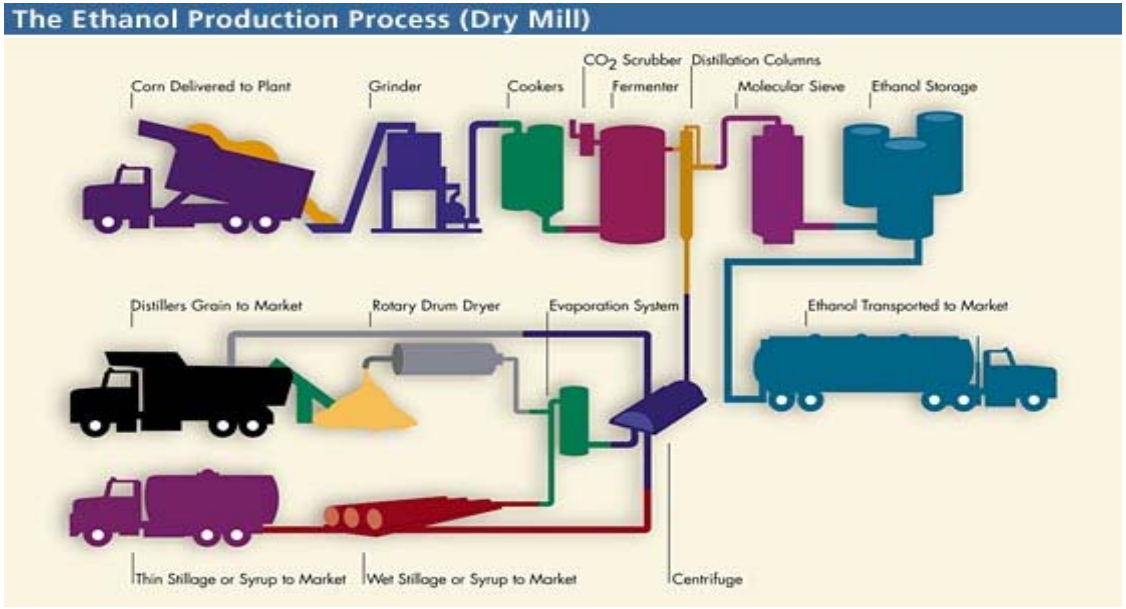
Use: increase octane and improve emissions quality of gasoline.

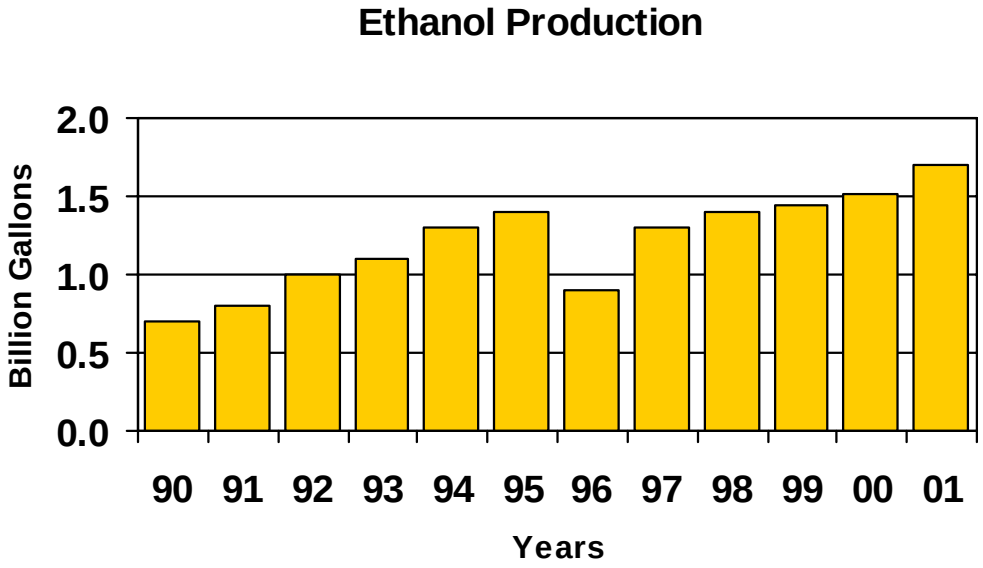
Two production processes: wet milling, dry milling (next slide).

Byproducts: stillage further processed to make:
- **CDS (condensed distillers syrup).**
- **DDGS (dried distillers grains with solubles) for livestock feed.**
- **CO2 released during fermentation sold to carbonate soft drinks & make dry ice.**

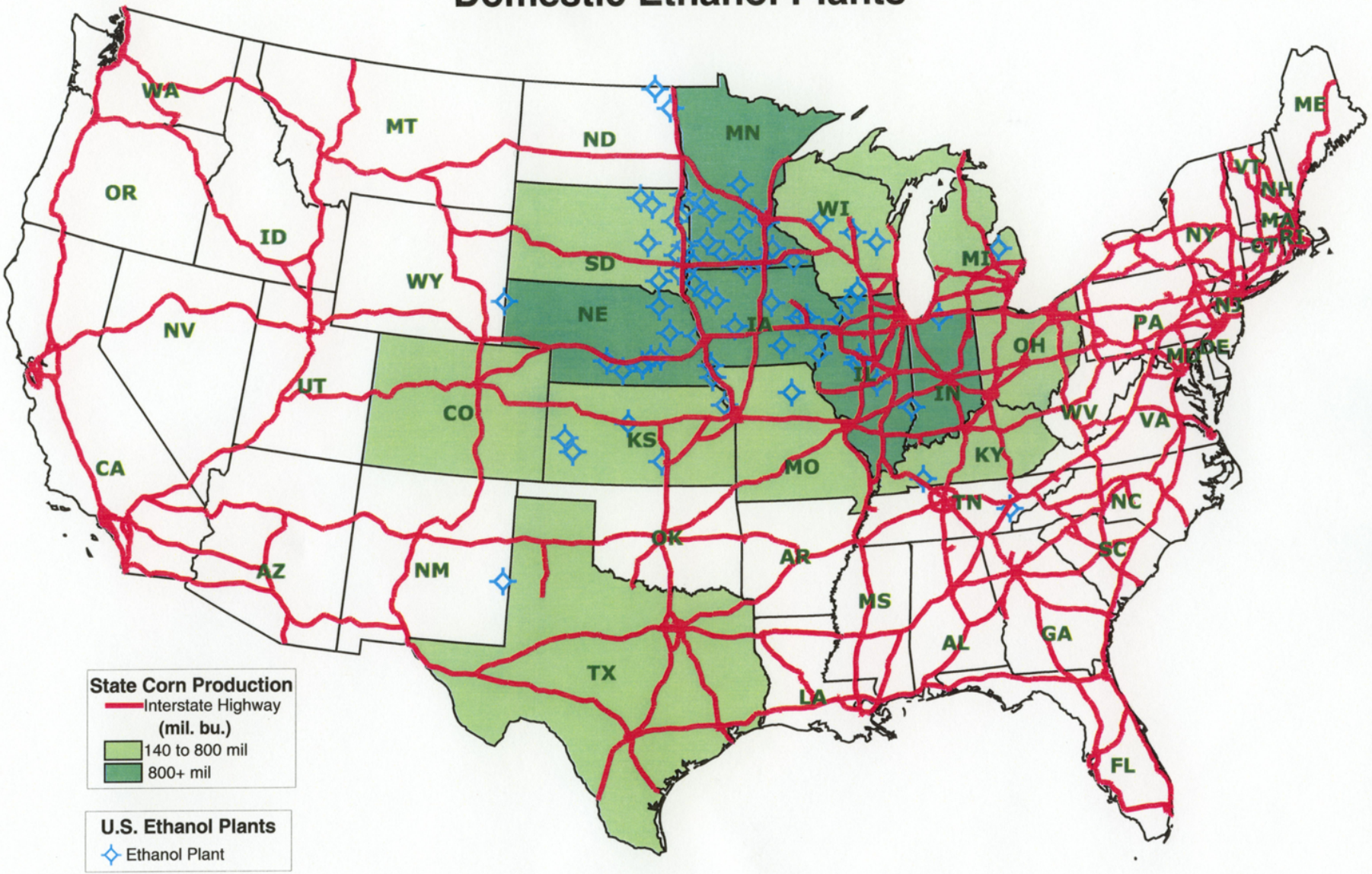
Production has risen steadily since 1990, except for dip in 1996-97.

2001 production topped 1.7 billion gallons.


The Ethanol Production Process (Dry Mill)
Corn Delivered to Plant
Grinder
Cookers
CO_2 Scrubber
Fermenter
Distillation Columns
Molecular Sieve
Ethanol Storage
Distillers Grain to Market
Rotary Drum Dryer
Evaporation System
Ethanol Transported to Market
Thin Stillage or Syrup to Market
Wet Stillage or Syrup to Market
Centrifuge

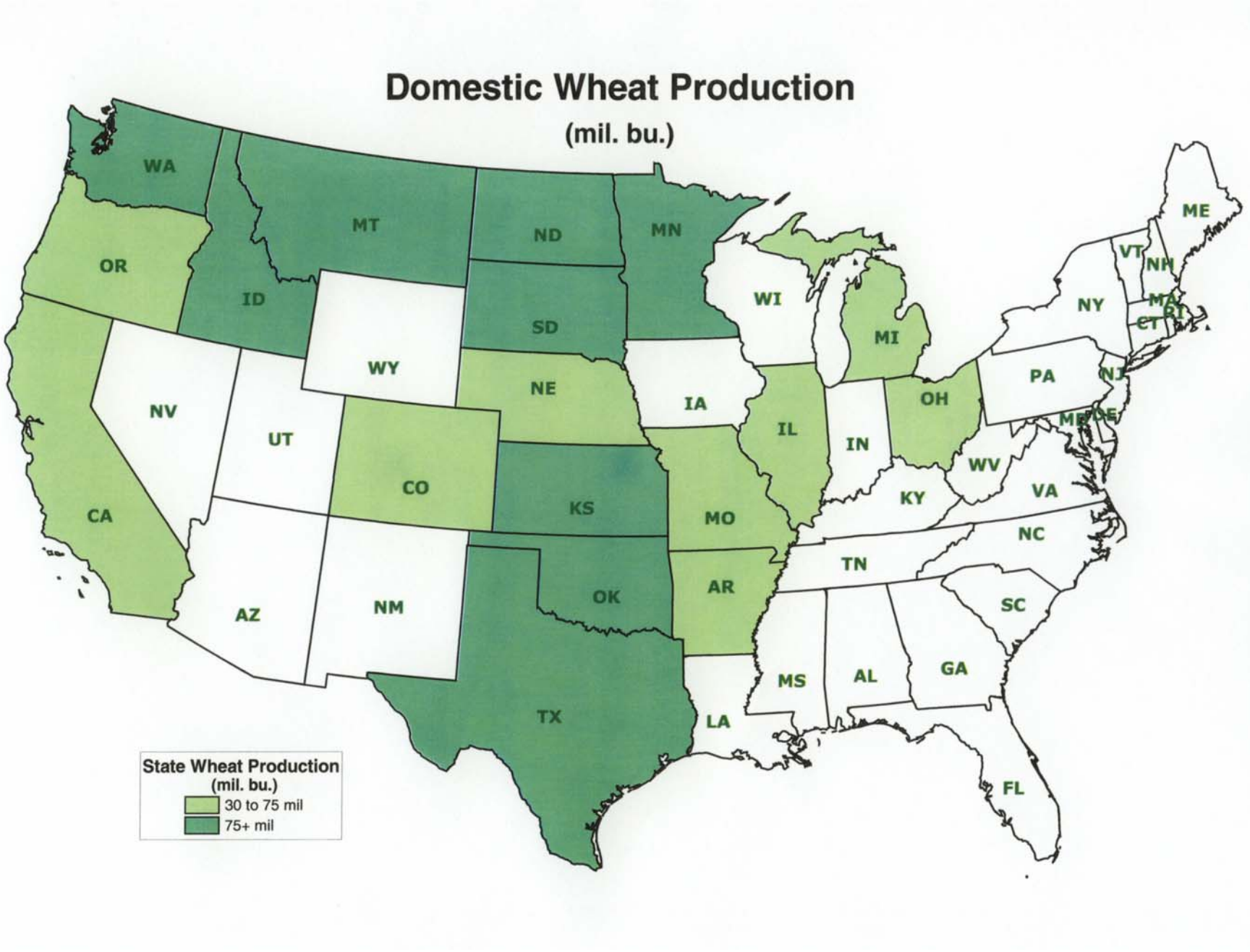

Ethanol Production
Billion Gallons
2.0
1.5
1.0
0.5
0.0
90
91
92
93
94
95
96
97
98
99
00
01
Years

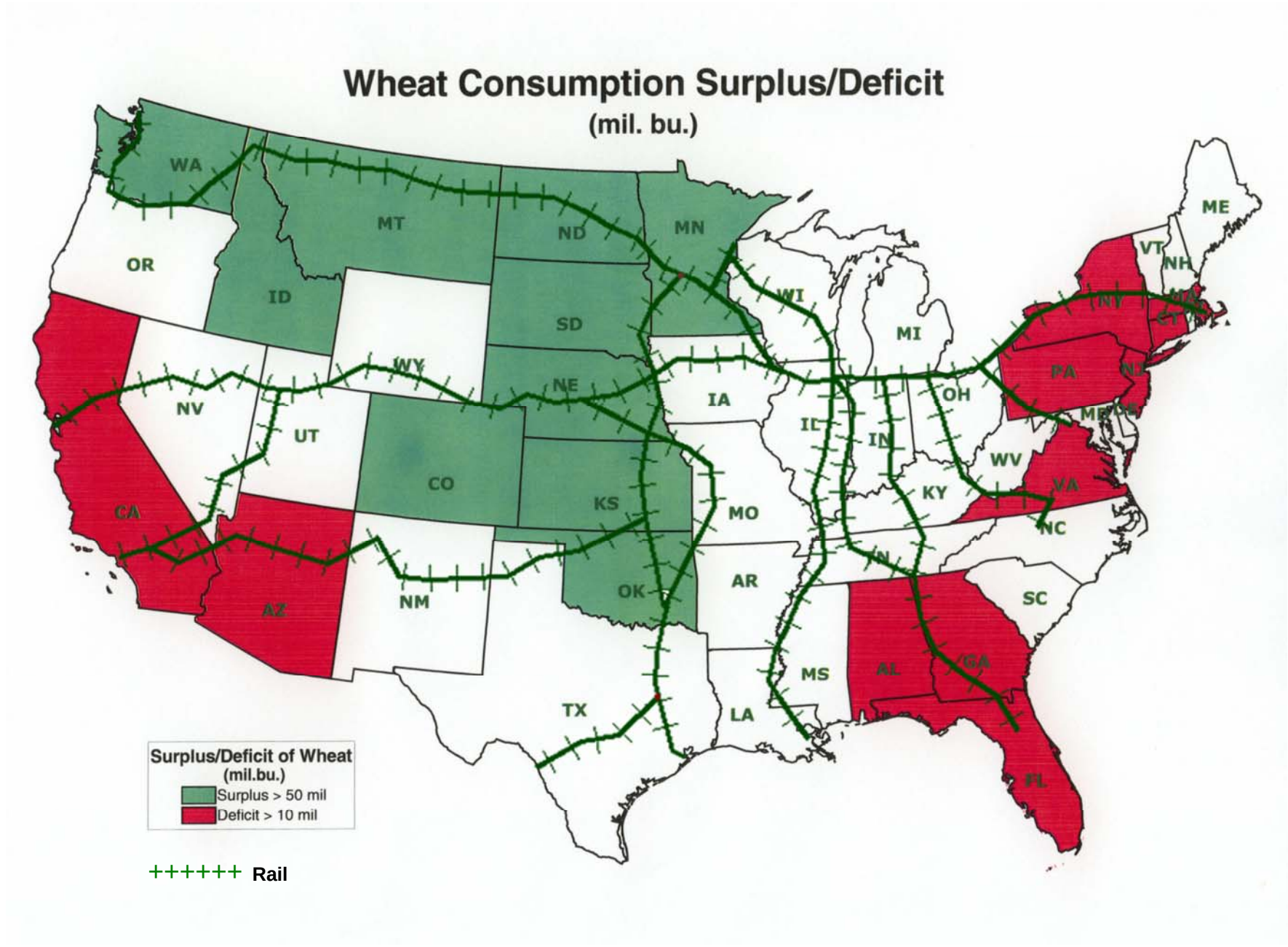
Domestic Ethanol Plants



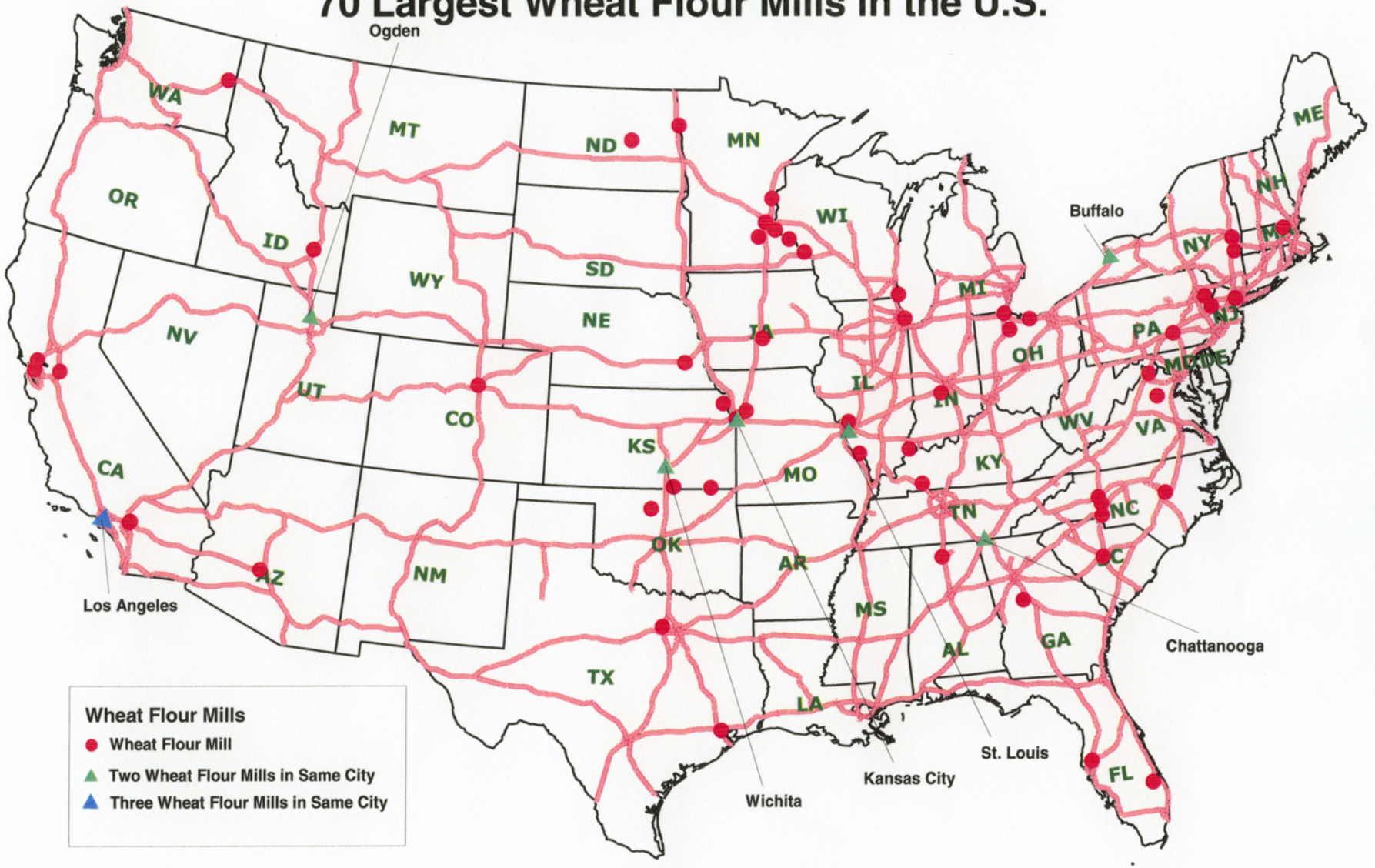
Wheat Facts

- In 2001, the U.S. produced nearly 2 billion bushels of wheat.
- Most wheat consumed domestically is made into flour.
- Almost half of the U.S. wheat crop is exported.
  - 36% ships out of the Pacific Northwest ports.
  - 26% ships out of the Texas Gulf ports.
  - 25% ships out of Mississippi River ports.
- Per capita consumption of wheat in the U.S. is 133.4 pounds (more than 2 bushels).


Domestic Wheat Production
(mil. bu.)
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DE
NJ
CT
RI
MA
VT
NH
ME
State Wheat Production
(mil. bu.)
30 to 75 mil
75+ mil


Wheat Consumption Surplus/Deficit
(mil. bu.)
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
VT
NH
ME
Surplus/Deficit of Wheat
(mil.bu.)
Surplus > 50 mil
Deficit > 10 mil
++++++ Rail

70 Largest Wheat Flour Mills in the U.S.

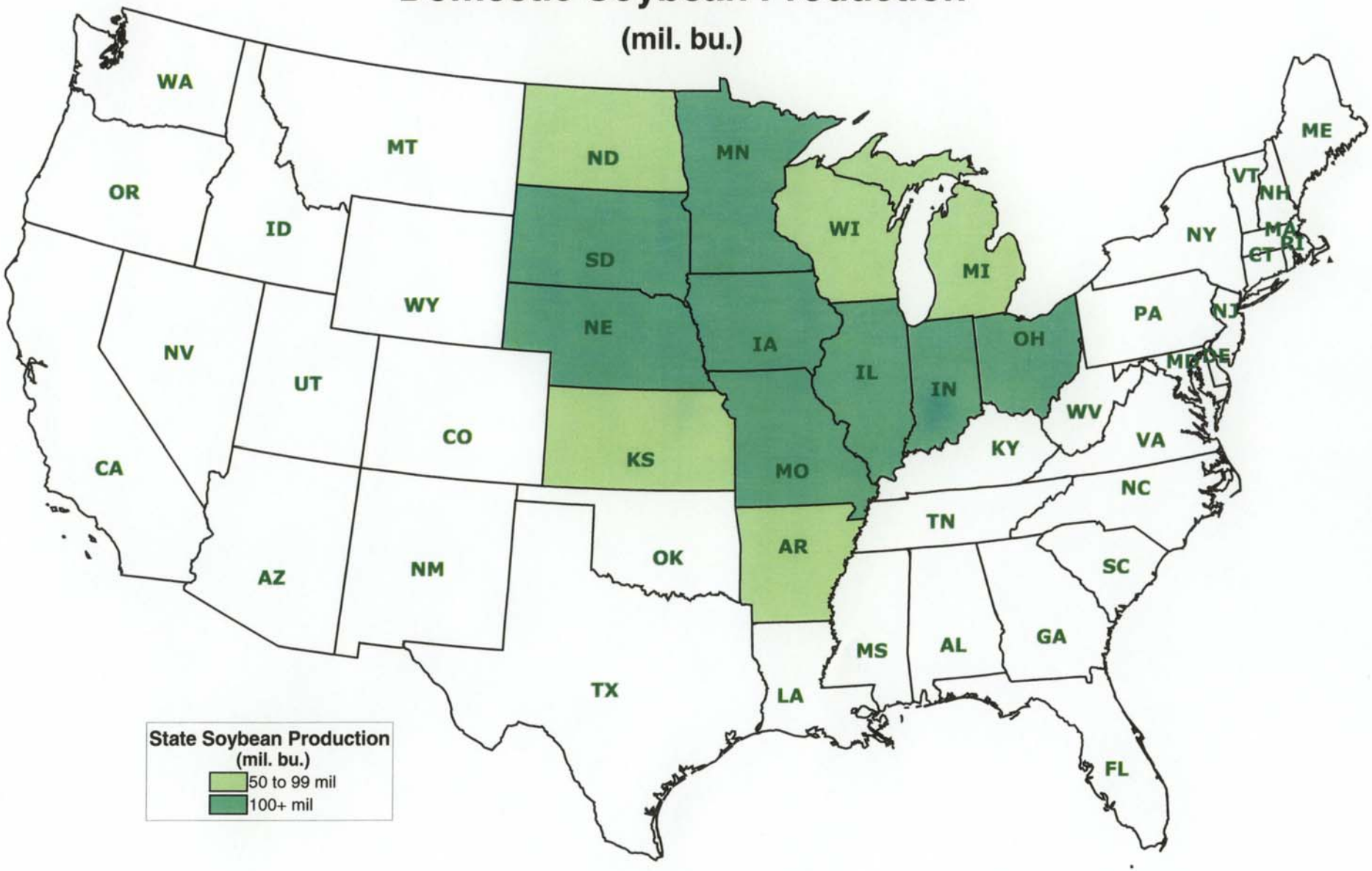


Soybean Facts

- In 2001, the U.S. produced 2.89 billion bushels of soybeans.
- Exports accounted for 36% of U.S. soybeans.
- Swine and poultry feed accounts for 75% of domestic soybean meal consumption, about 37% of total soybean crop.
- Soybeans provide 83% of the edible fats and oils in the U.S.
- 1 bushel of soybeans equals 48 pounds of meal.
- 1 bushel of soybeans equals 12 pounds of oil.

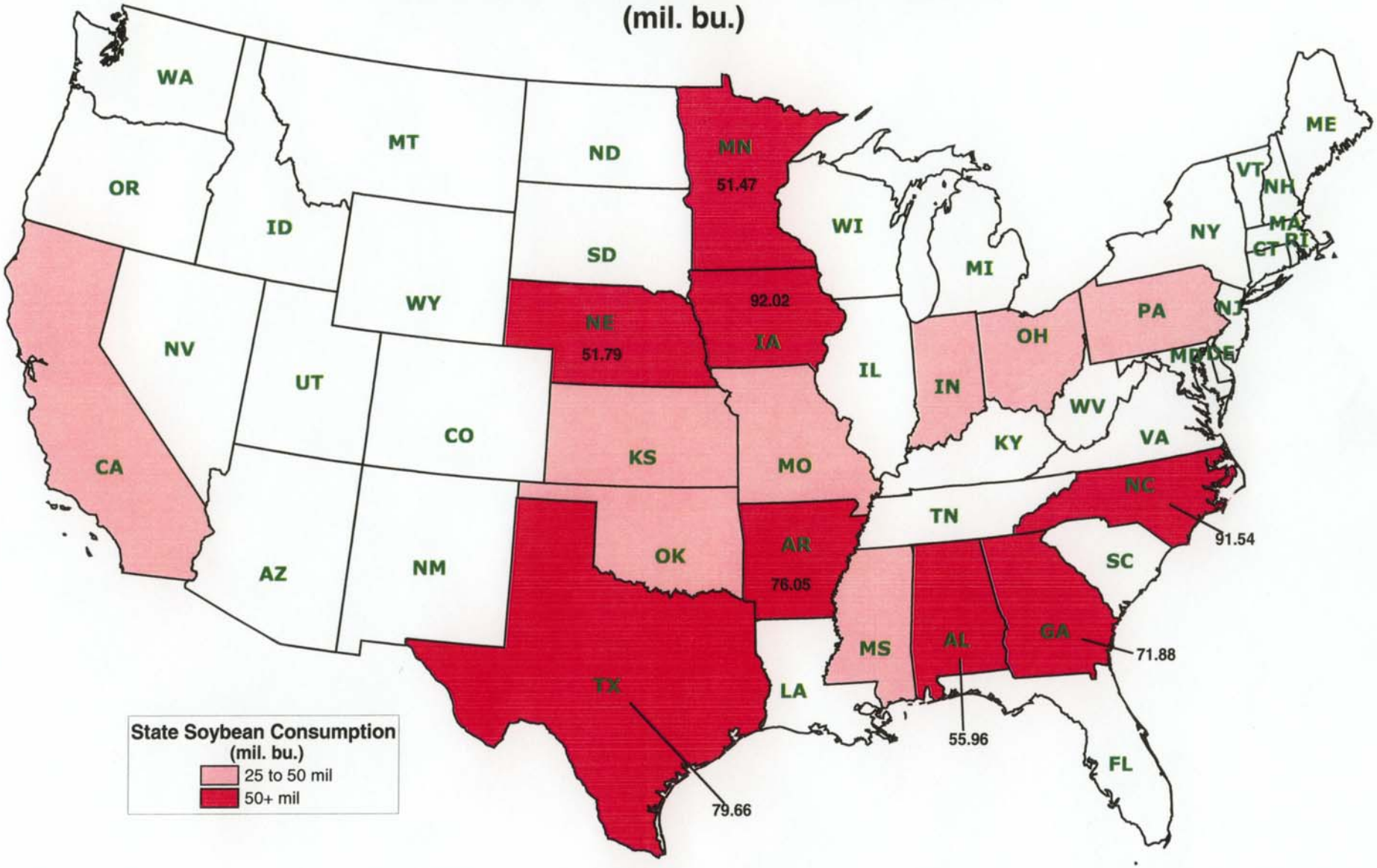
Domestic Soybean Production

(mil. bu.)



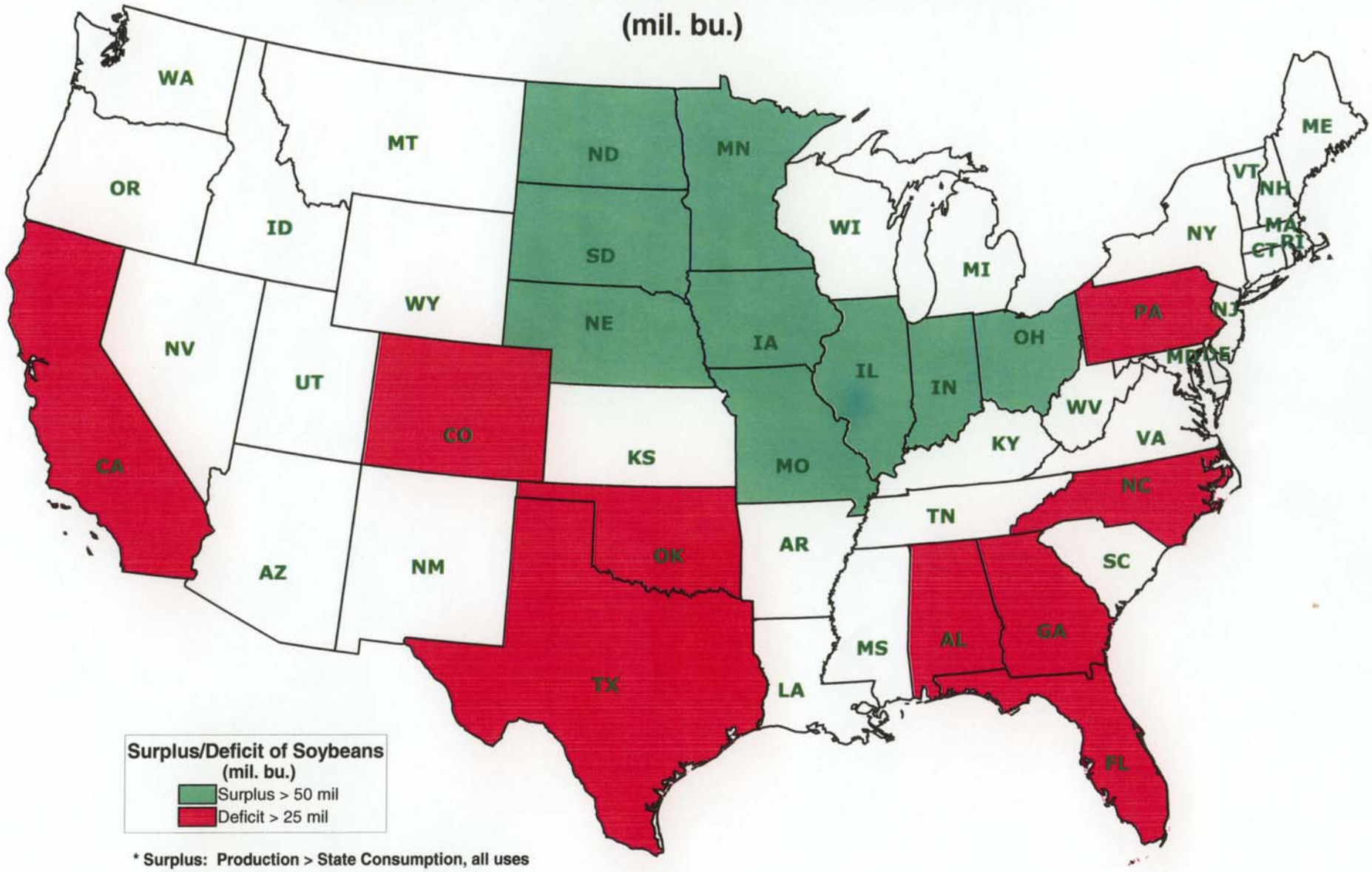
Domestic Soybean Consumption

(mil. bu.)



Soybean Consumption Surplus*/Deficit**

(mil. bu.)

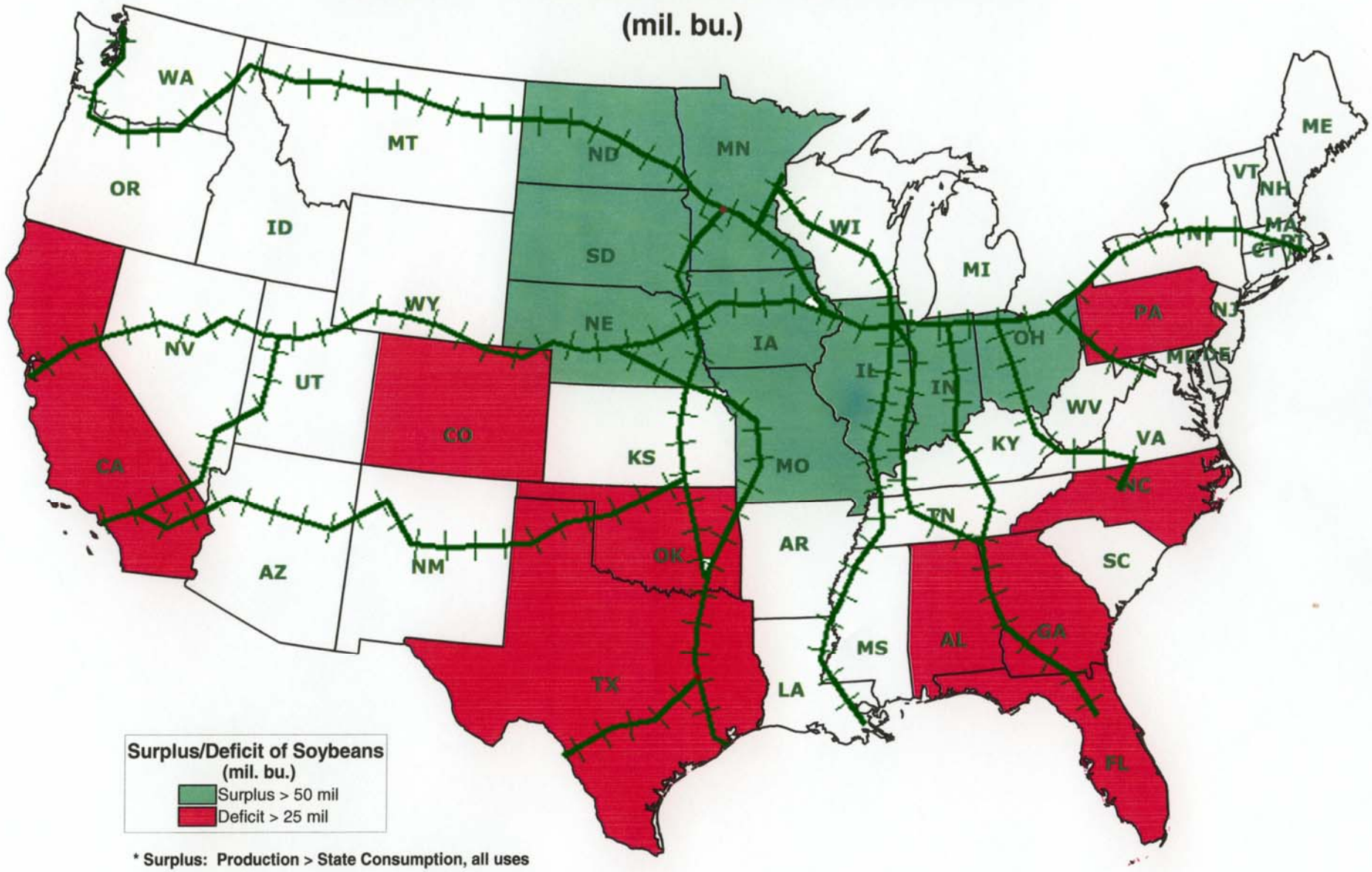


* Surplus: Production > State Consumption, all uses

** Deficit: Production < State Consumption, all uses

Soybean Consumption Surplus*/Deficit**

(mil. bu.)



* Surplus: Production > State Consumption, all uses

** Deficit: Production < State Consumption, all uses

++++++ Rail

Produce Transportation

The following slides show production, consumption, and surplus/deficit maps for lettuce, apples, and potatoes.

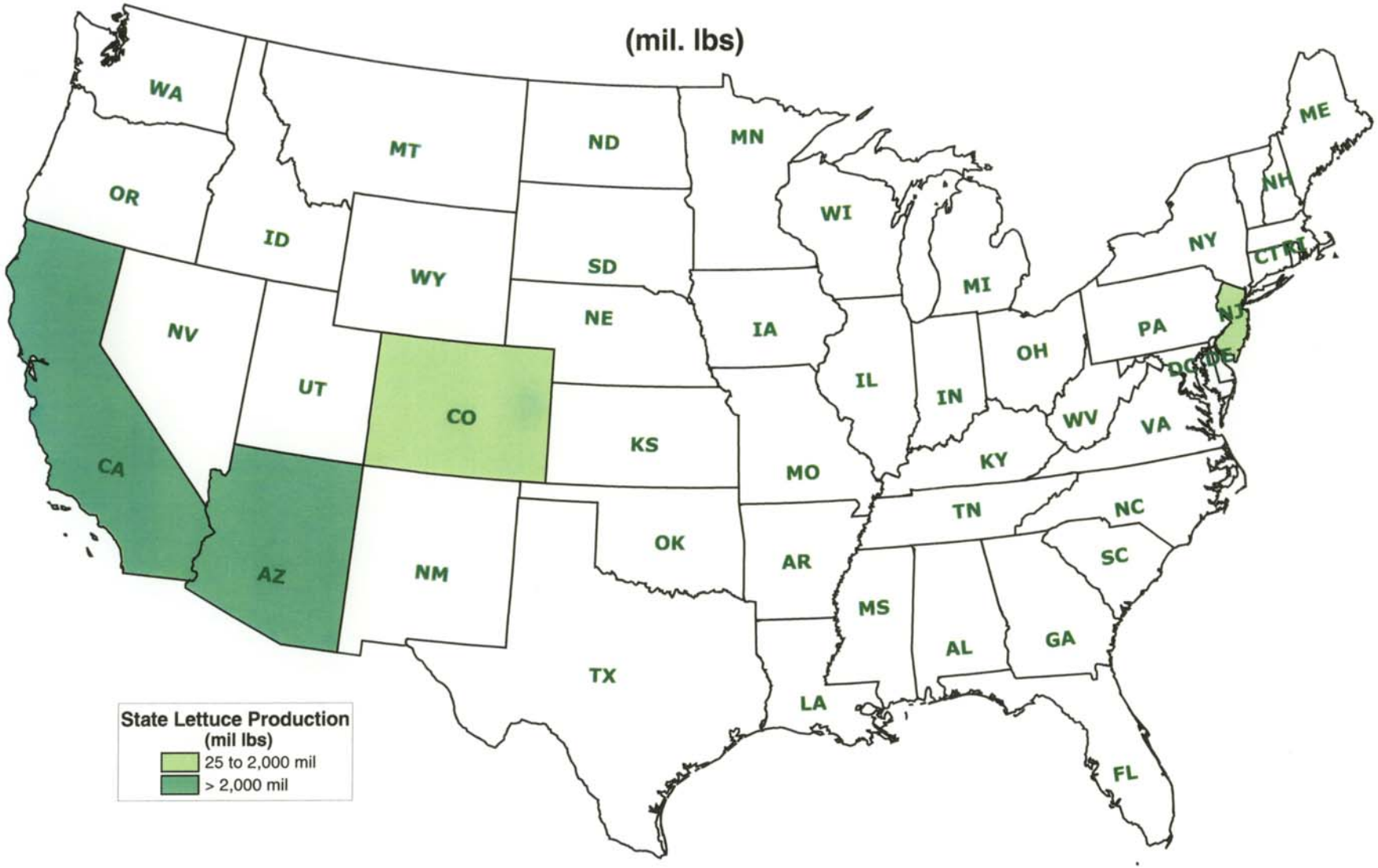
Maps also show by what mode of transportation the commodities move.

Lettuce Facts

- California produces nearly 70% of U.S. head lettuce.
- Arizona produces 30% of U.S. head lettuce.
- Approximately 25% of lettuce is fresh cut for salad mixes.
- In 2001, U.S. per capita lettuce consumption was 22.6 pounds.
- Lettuce is shipped primarily by truck, with some shipped by refrigerated railcars or containers on a flat railcar (piggyback).
- U.S. exported $110 million of lettuce in 2001, with 85% going to Canada.

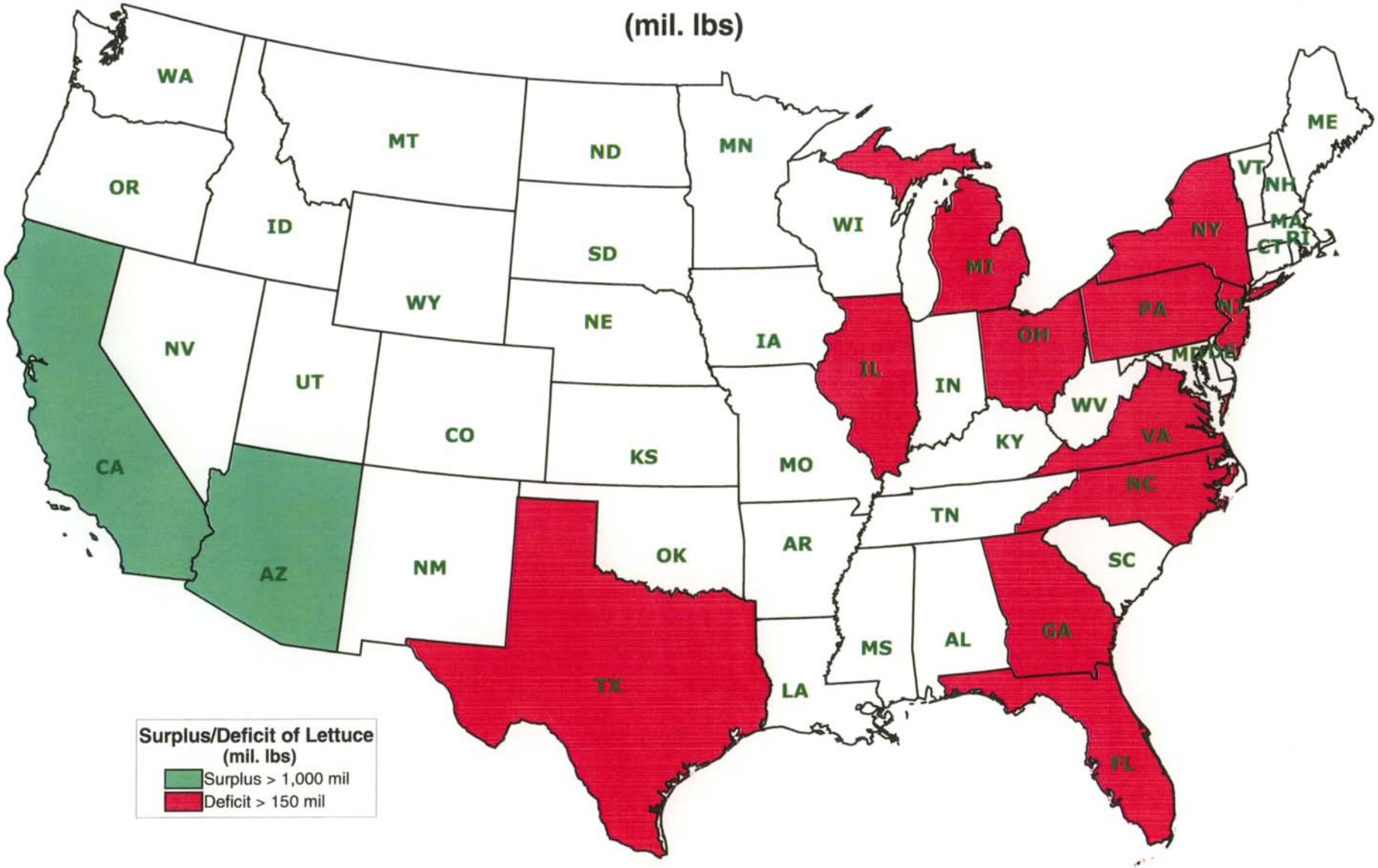
Domestic Lettuce Production

(mil. lbs)



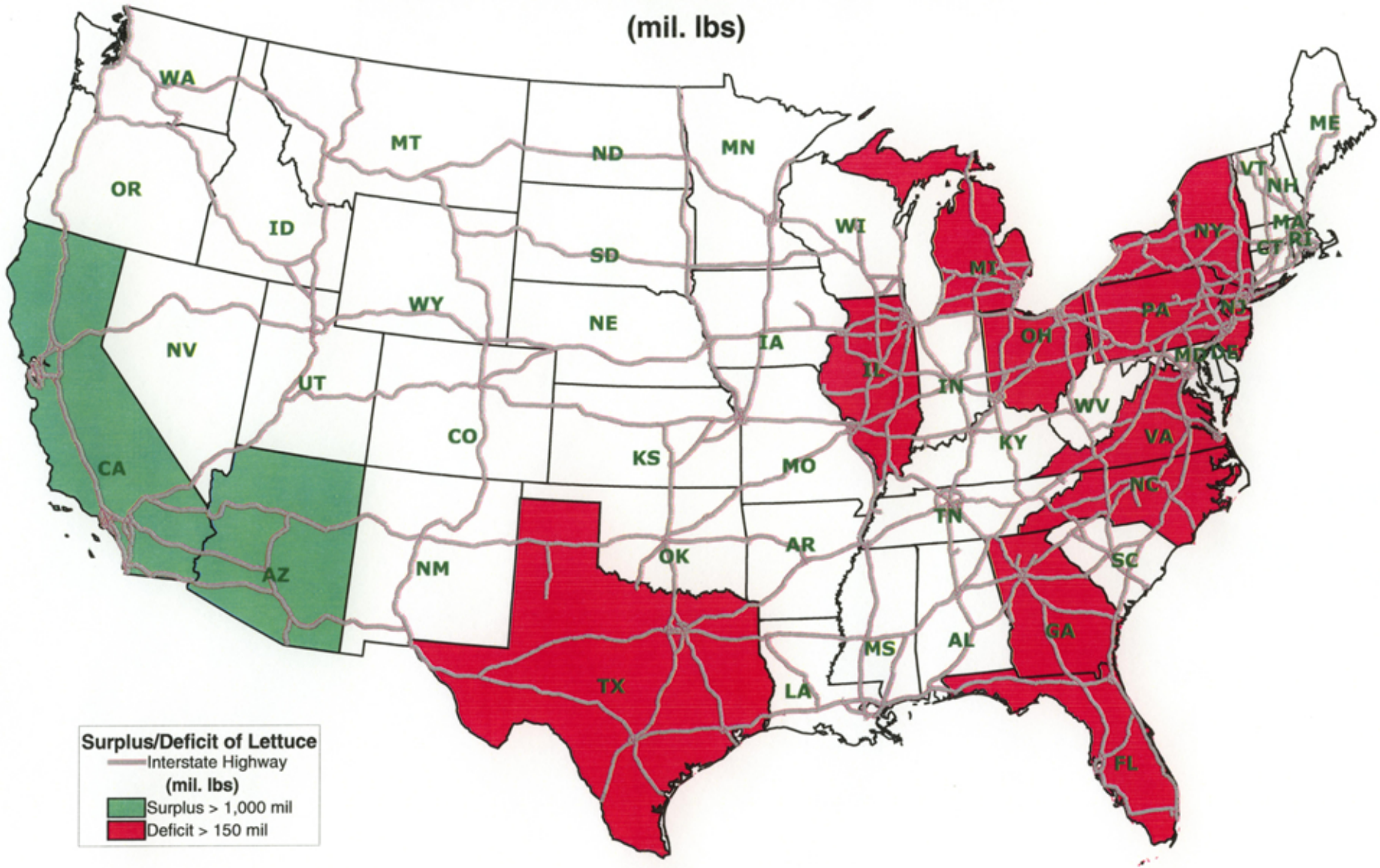
Lettuce Consumption Surplus/Deficit

(mil. lbs)



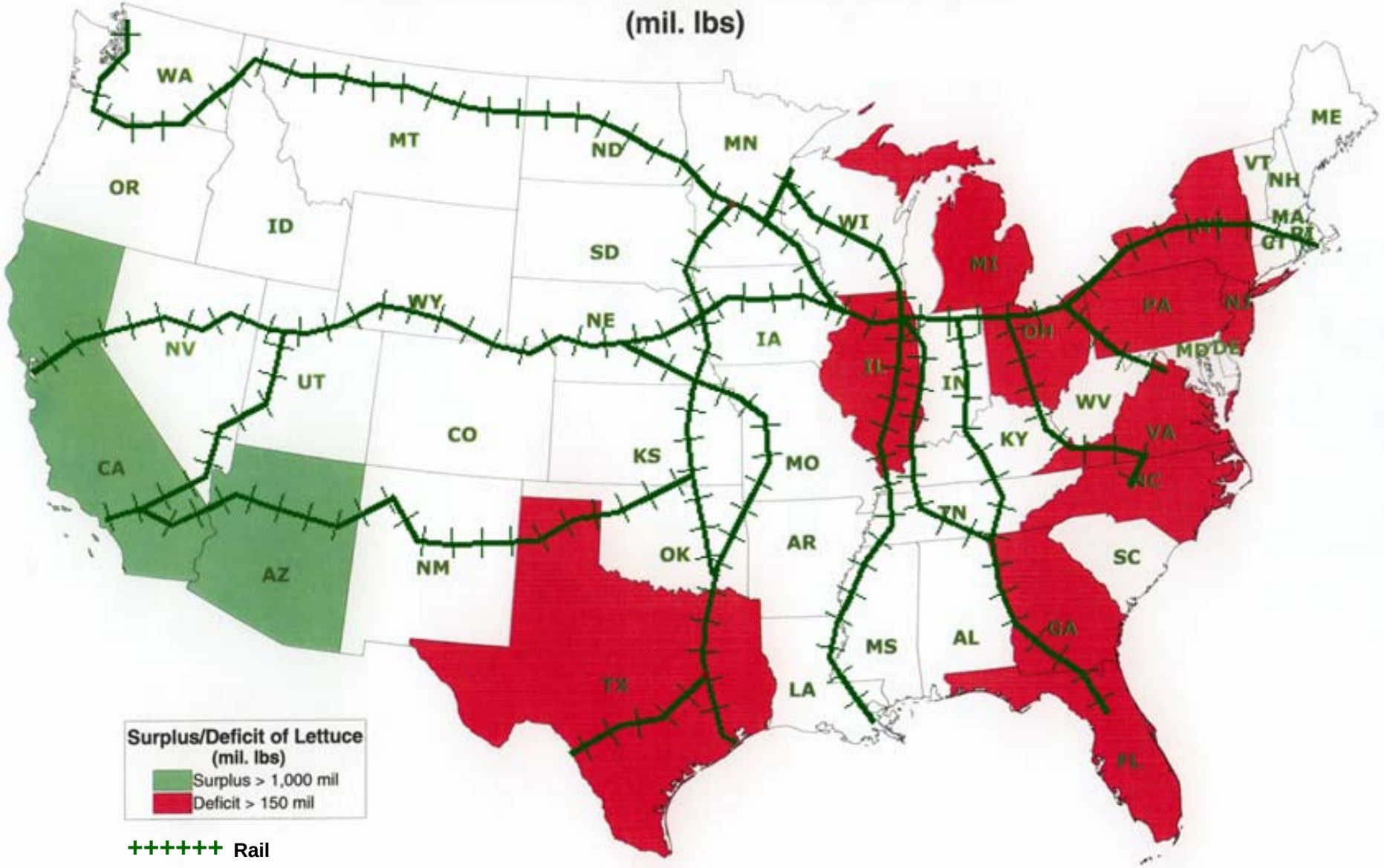
Lettuce Consumption Surplus/Deficit

(mil. lbs)

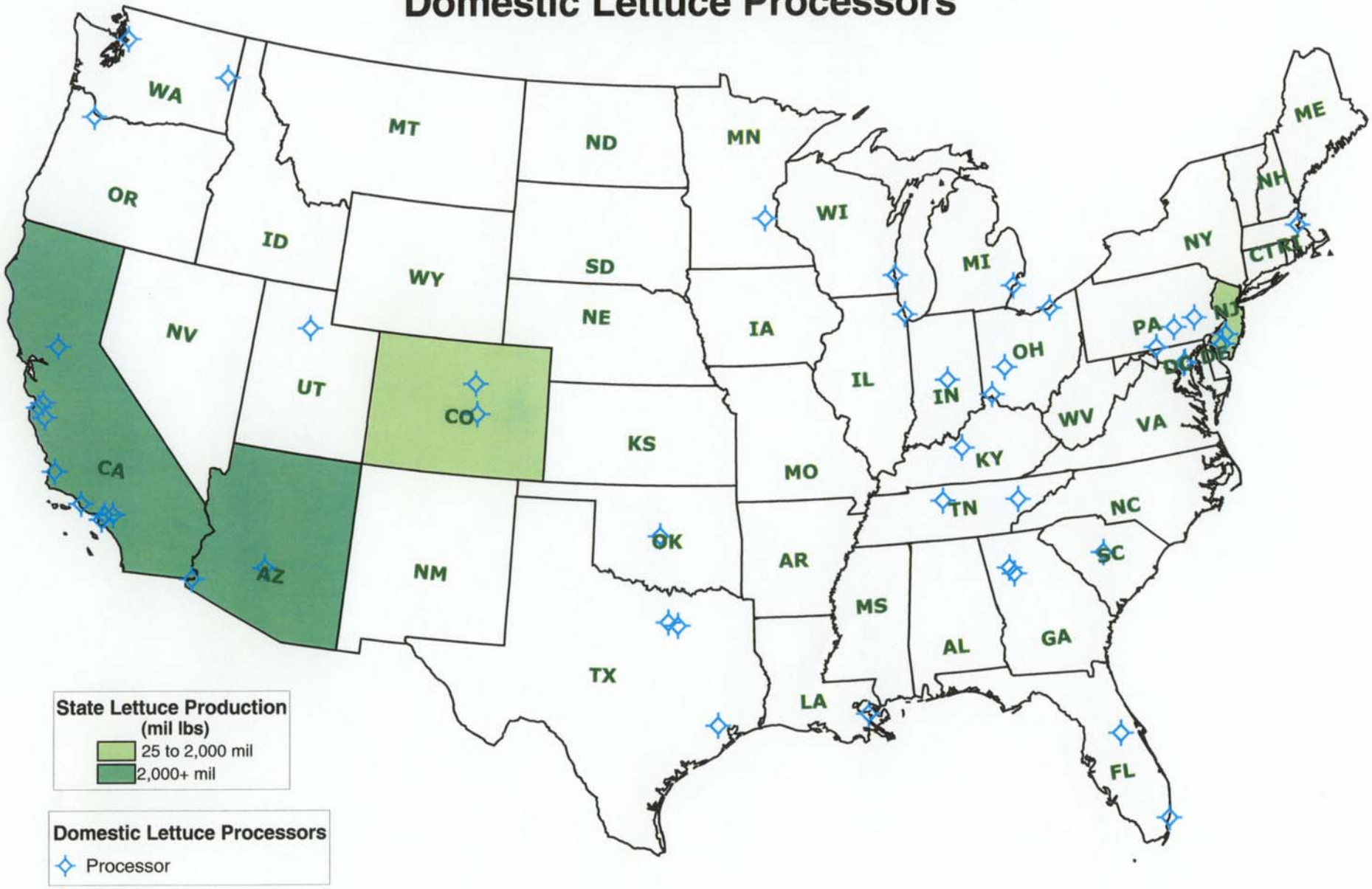


Lettuce Consumption Surplus/Deficit

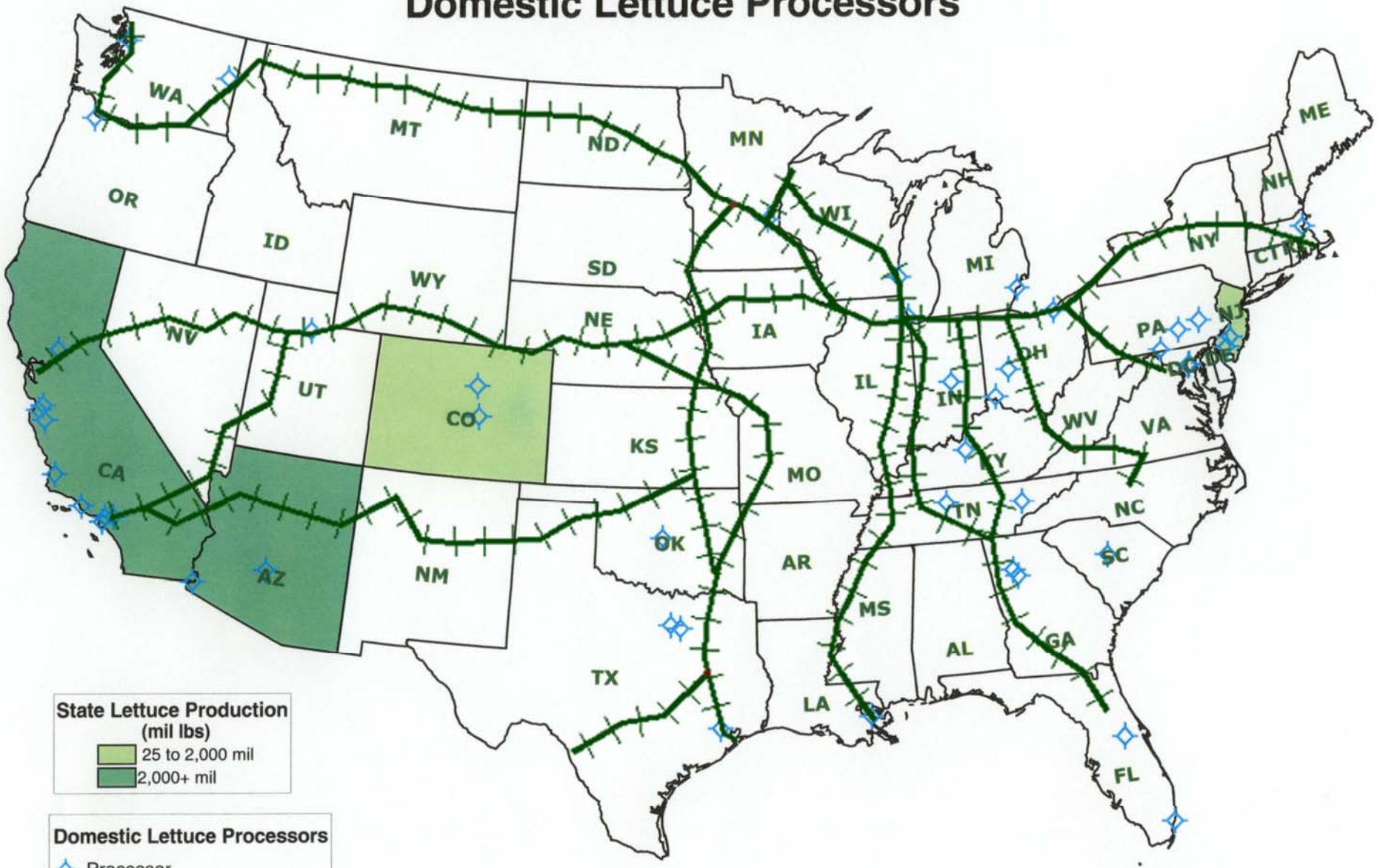
(mil. lbs)



Domestic Lettuce Processors



Domestic Lettuce Processors



Ports of Departure for U.S. Head Lettuce Exports

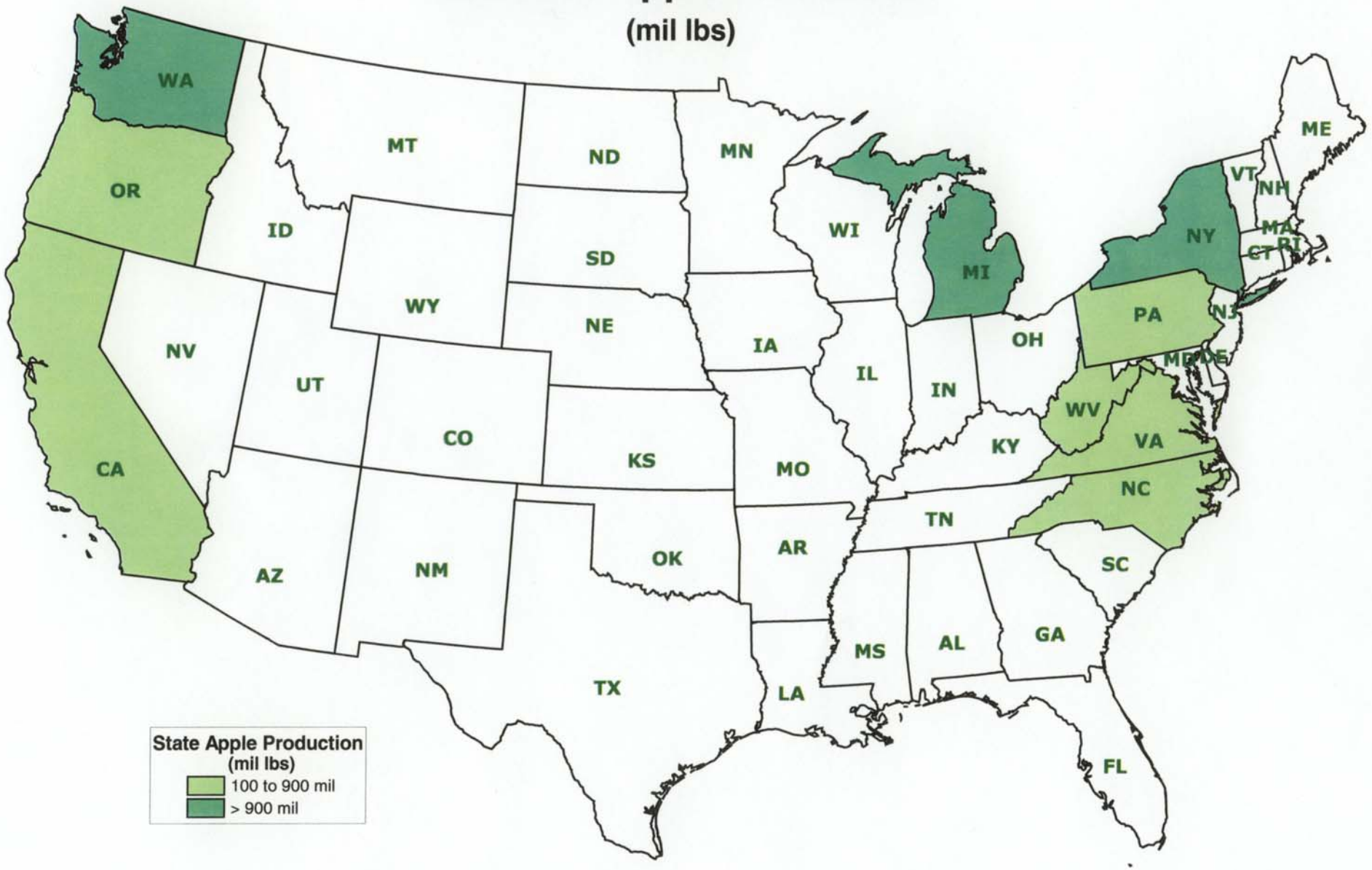
Source: USDA/FAS and PIERS

Apple Facts

- Washington State produces more than 50% of U.S. apples, followed by New York with 11%, and Michigan with 10%.
- In 2001, there were 8,000 apple growers with orchards covering 430,200 acres.
- More than 60% of U.S. apples are consumed fresh.
- Nearly 25% of the U.S. fresh apple crop is exported.
  - Canada and Mexico buy nearly 50%.
  - 30% goes to Asian destinations.
- U.S. per capita consumption of fresh apples is 17.4.
- Approximately 97% of apples are transported by truck.

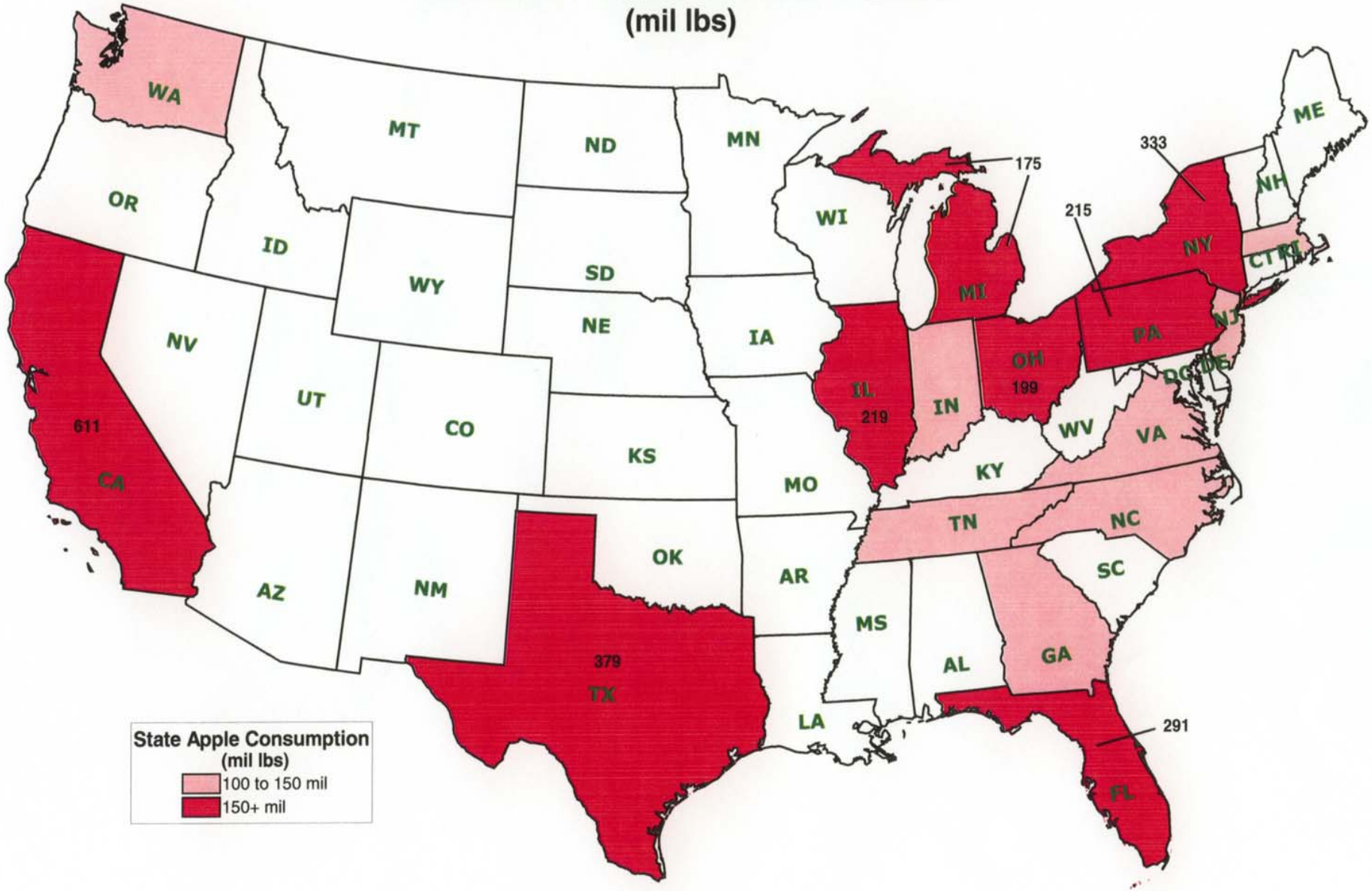
Domestic Apple Production

(mil lbs)



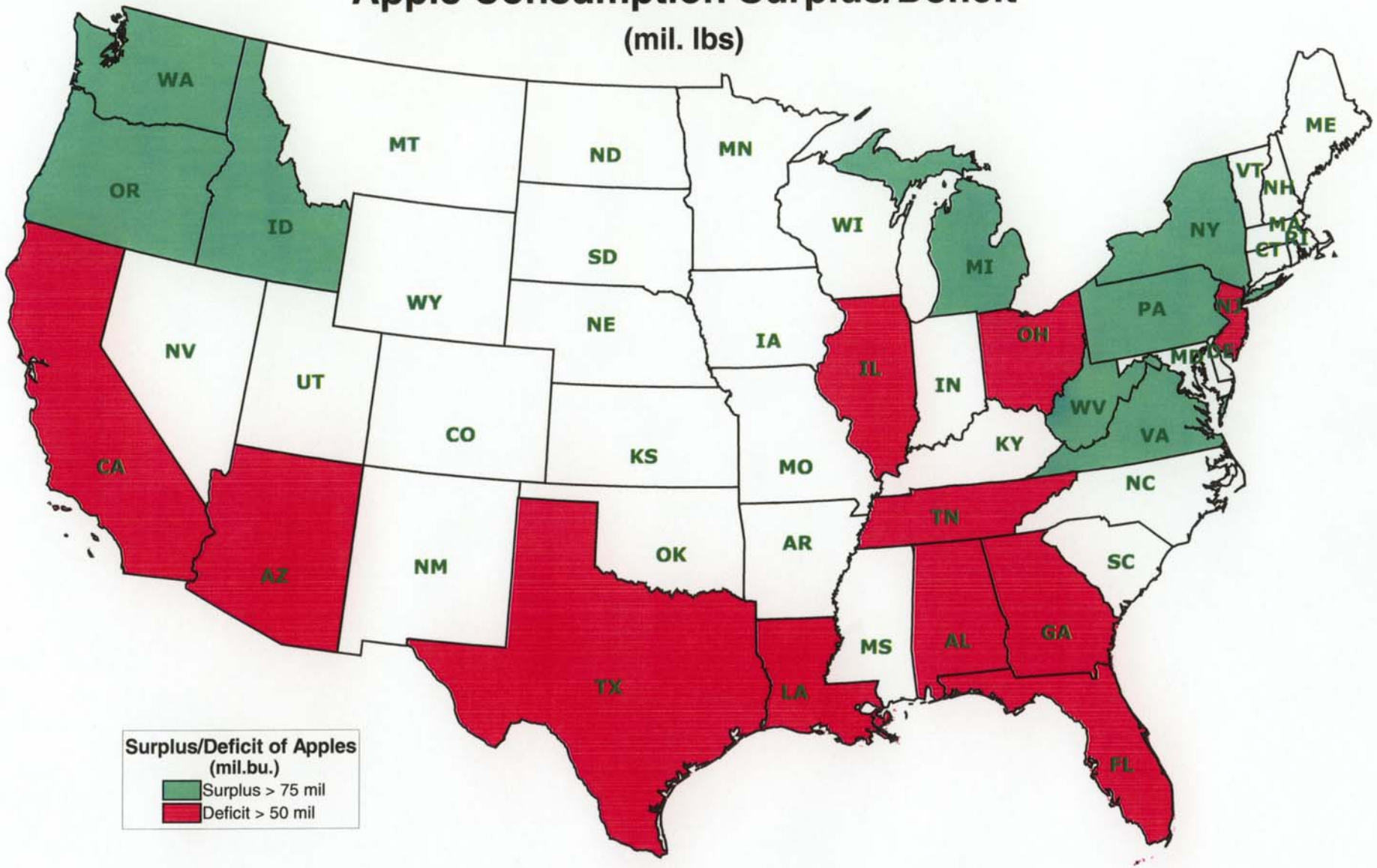
Domestic Apple Consumption

(mil lbs)



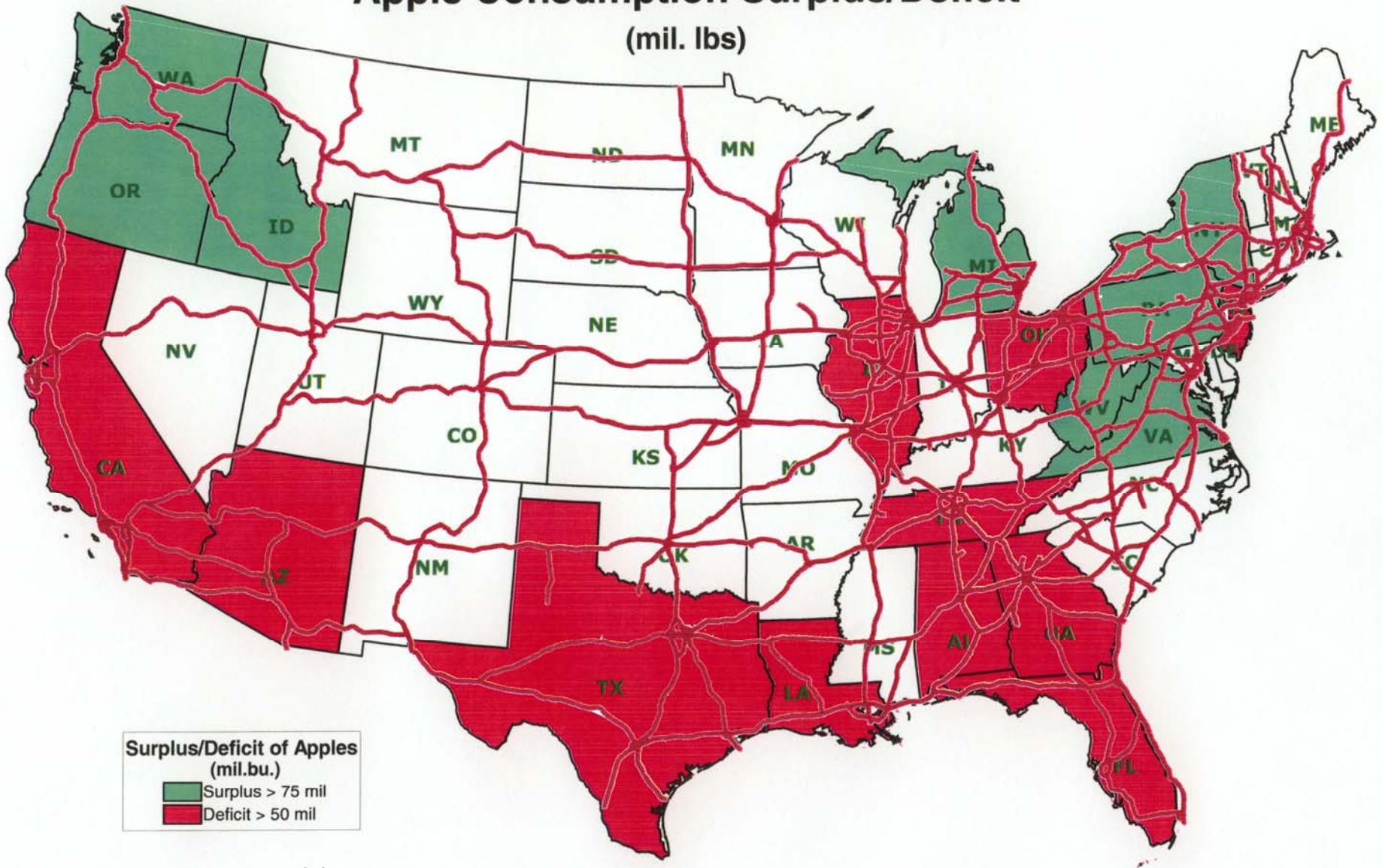
Apple Consumption Surplus/Deficit

(mil. lbs)



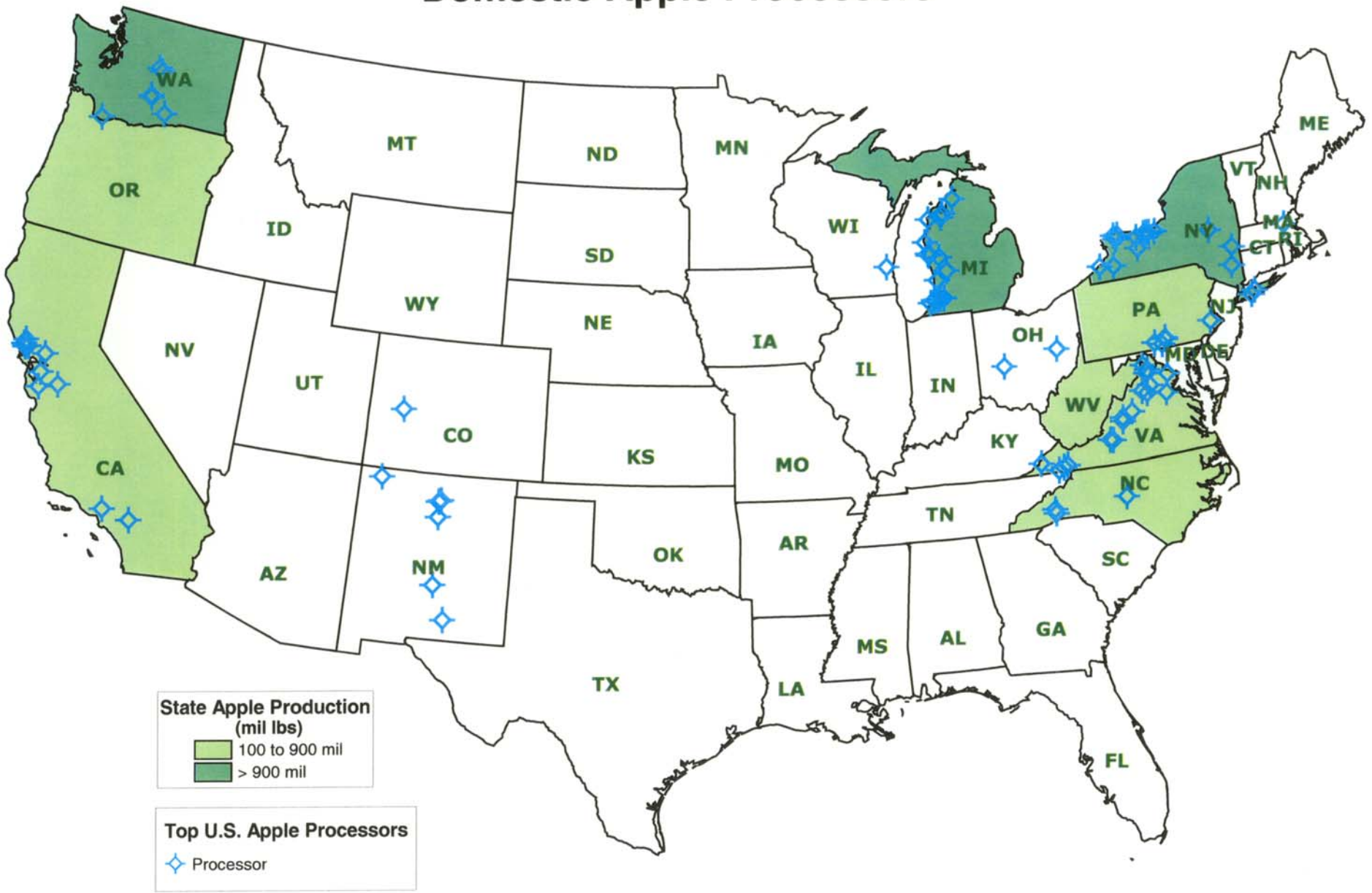
Apple Consumption Surplus/Deficit

(mil. lbs)

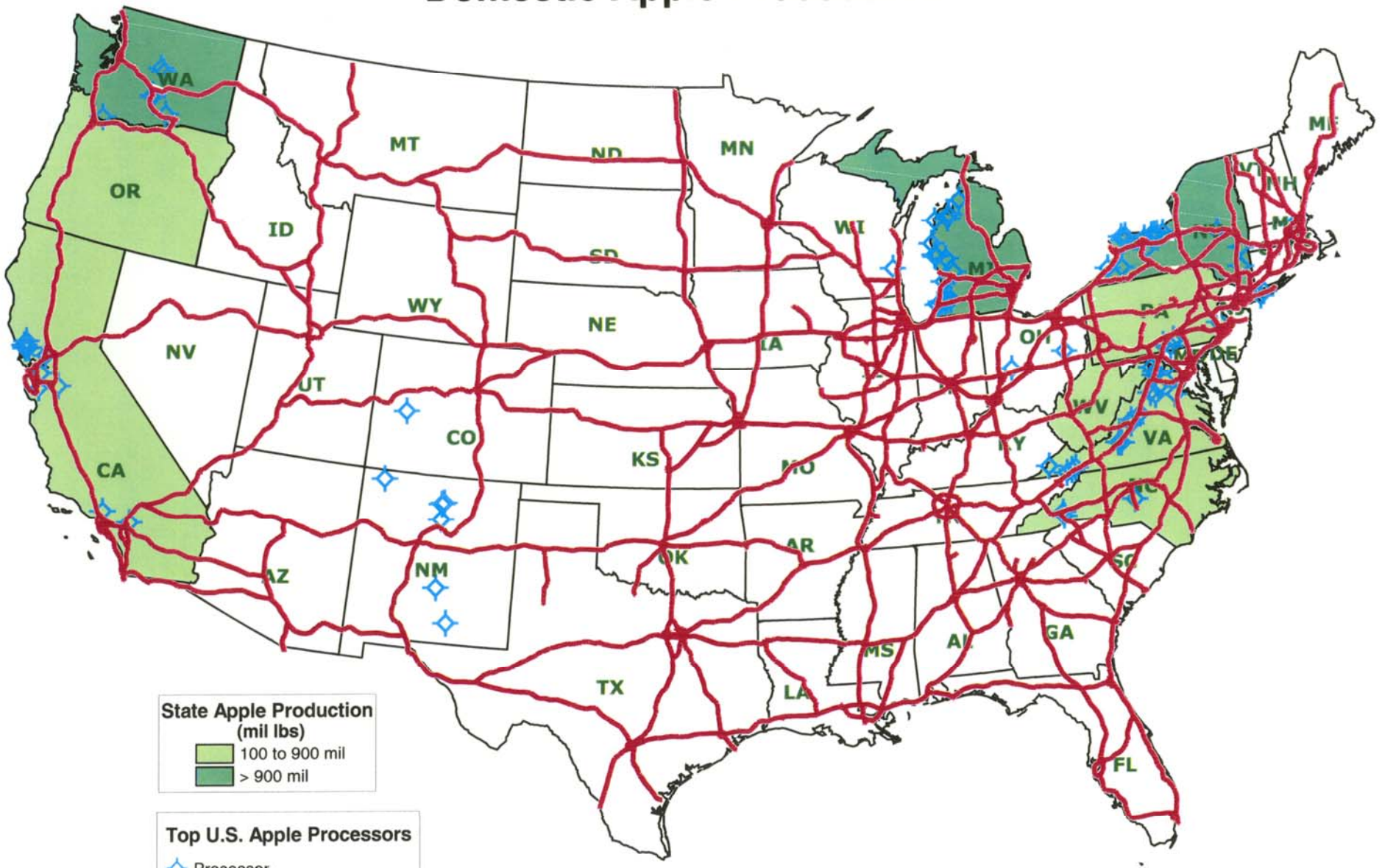


------ **Interstate Highway System**

Domestic Apple Processors



Domestic Apple Processors



Ports of Departure for U.S. Apple Exports

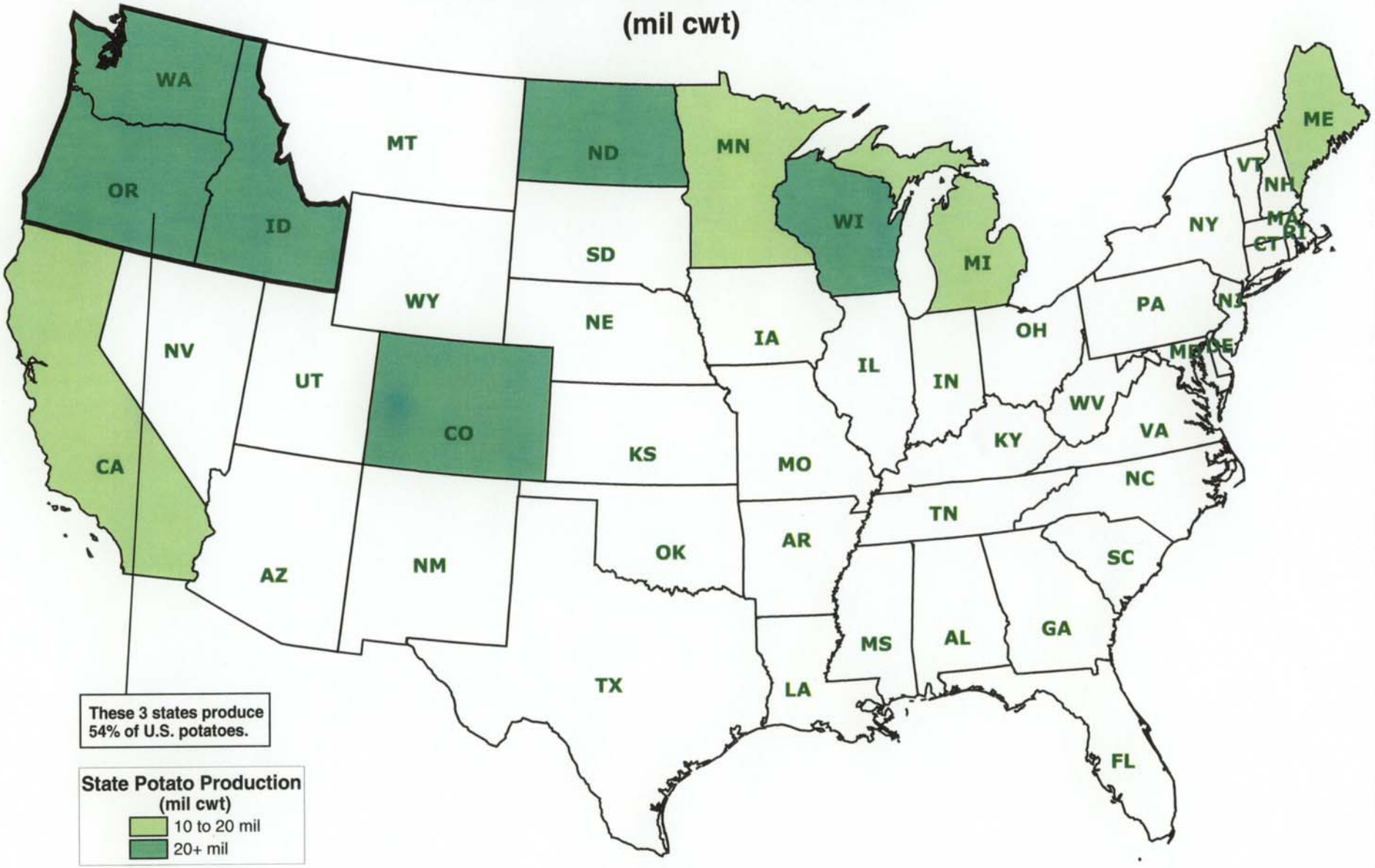
Source: USDA/FAS and PIERS

Potato Facts

- In 2001, the U.S. produced nearly 43 billion pounds of potatoes.
- 86% of U.S. potatoes are used for human consumption: of this, almost 68% is used in processed potato products, such as frozen fries and potato chips.
- U.S. per capita consumption of potatoes is 138.2 pounds.
- 87% of potatoes move by truck; 13% by rail.
- 1.5% of U.S. fresh potatoes are exported, with 94% going to Canada and Mexico.

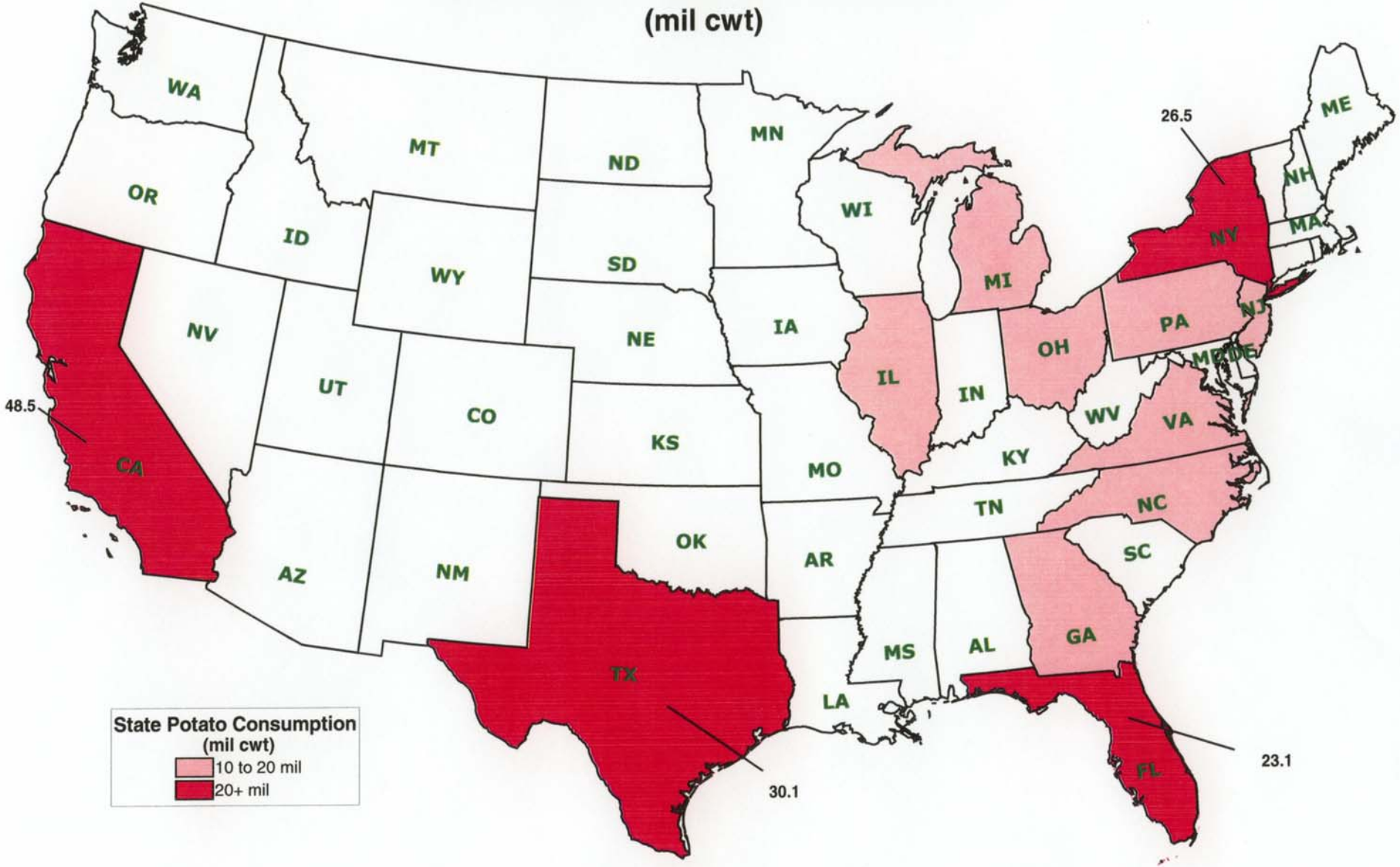
Domestic Potato Production

(mil cwt)



Domestic Potato Consumption

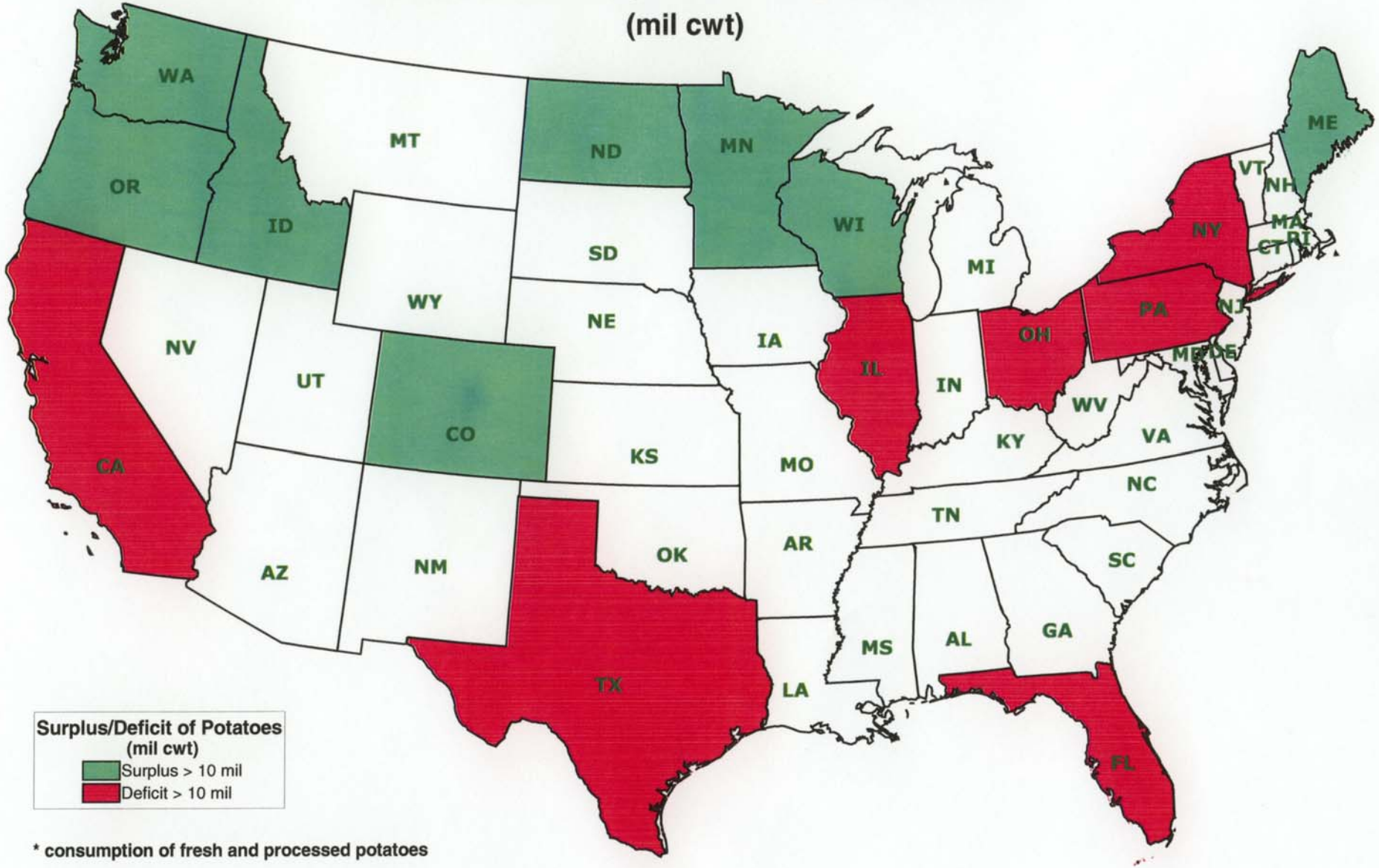
(mil cwt)



Source: USDA/National Agricultural Statistics Service

Potato Consumption* Surplus/Deficit

(mil cwt)

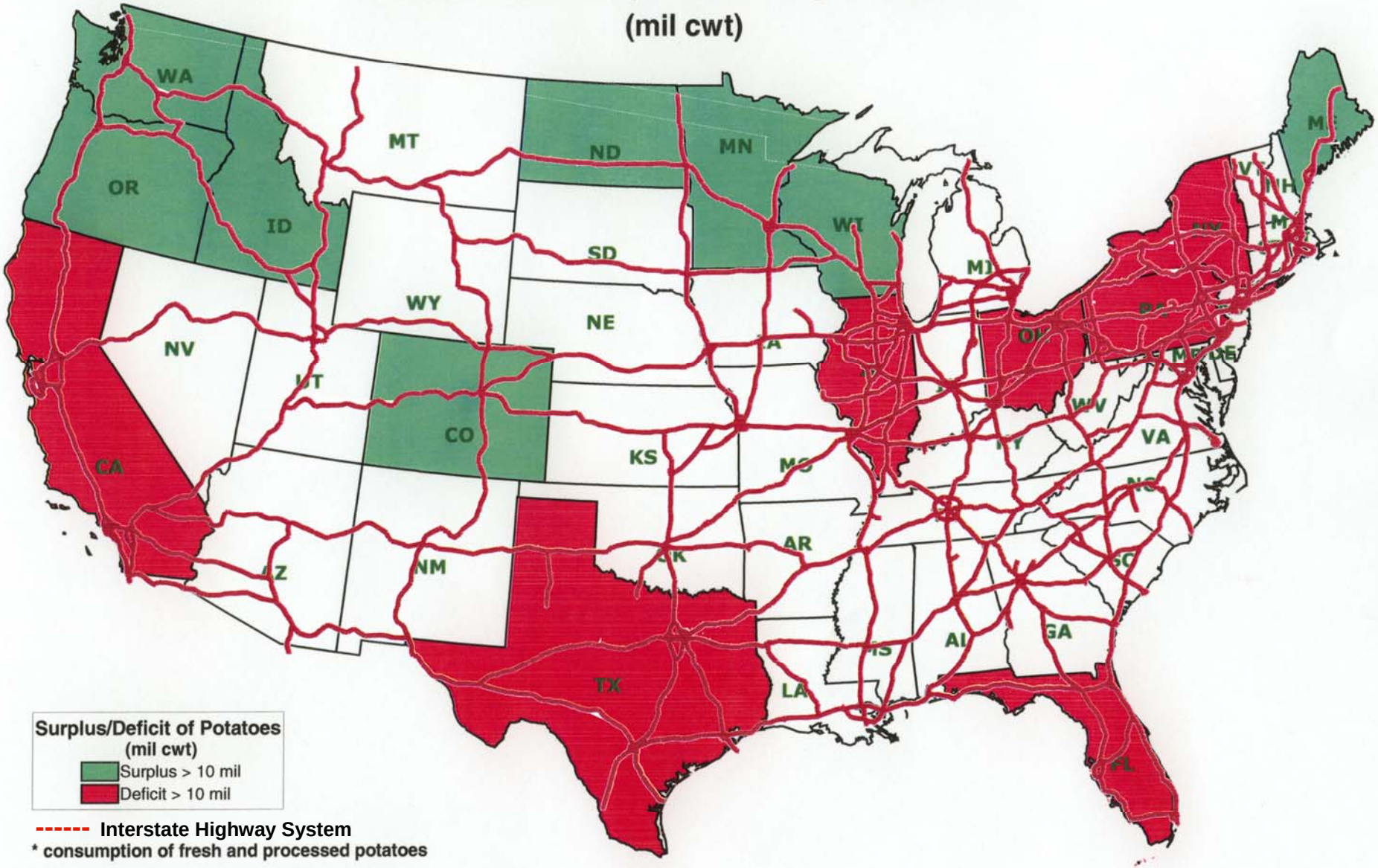


* consumption of fresh and processed potatoes

Source: U.S. Bureau of Census and USDA/National Agricultural Statistics Service

Potato Consumption* Surplus/Deficit

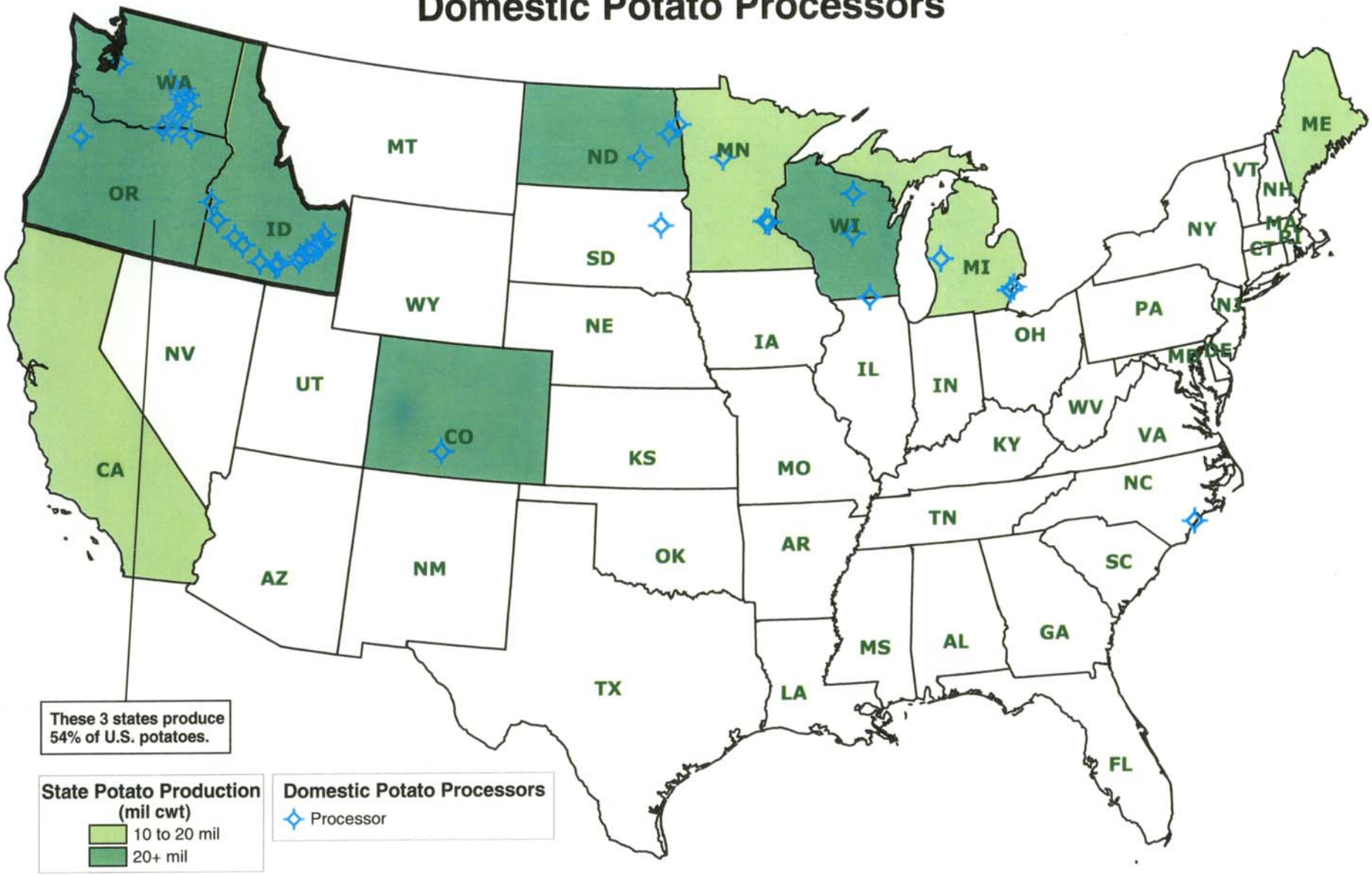
(mil cwt)



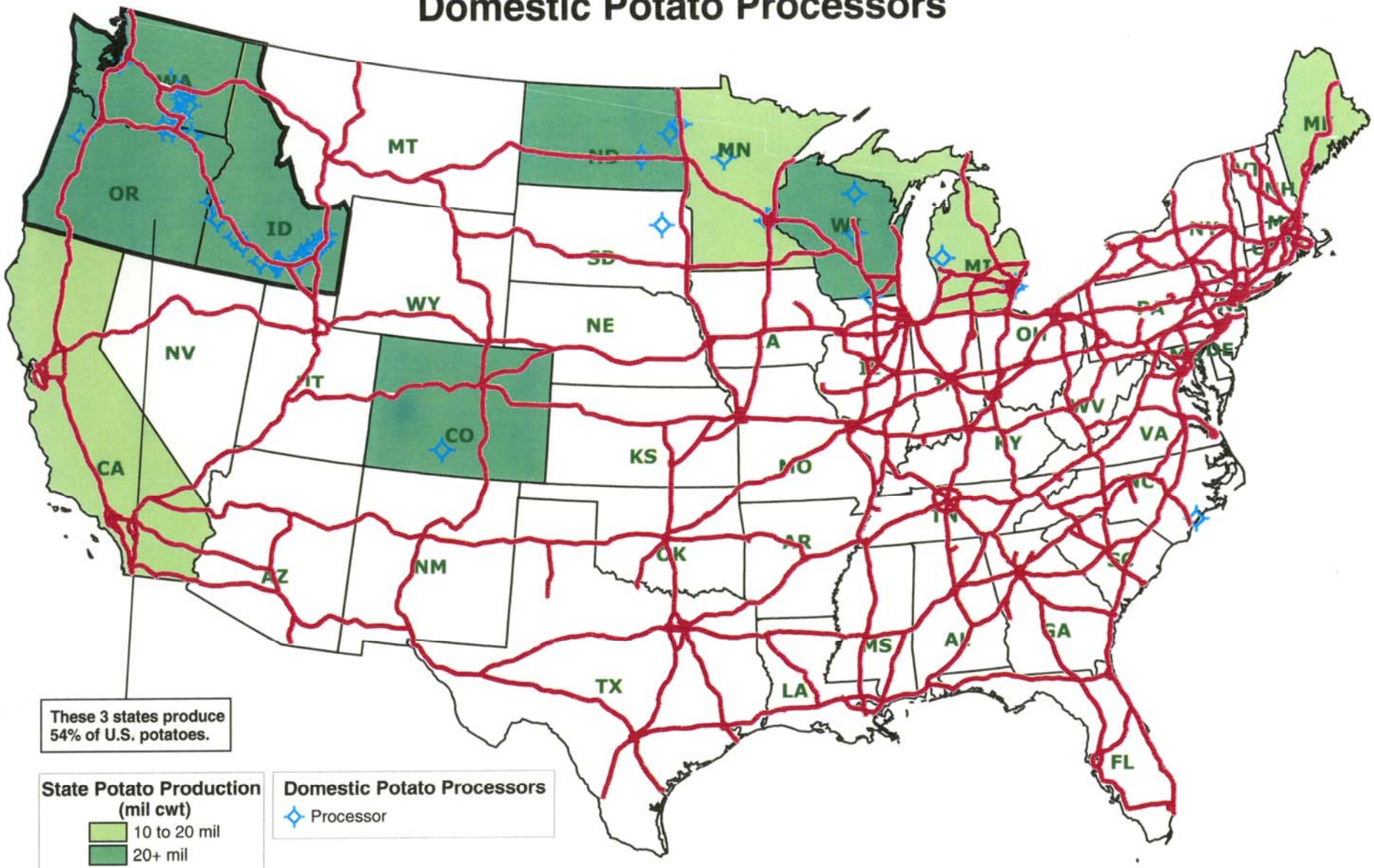
* consumption of fresh and processed potatoes

Source: U.S. Bureau of Census and USDA/National Agricultural Statistics Service

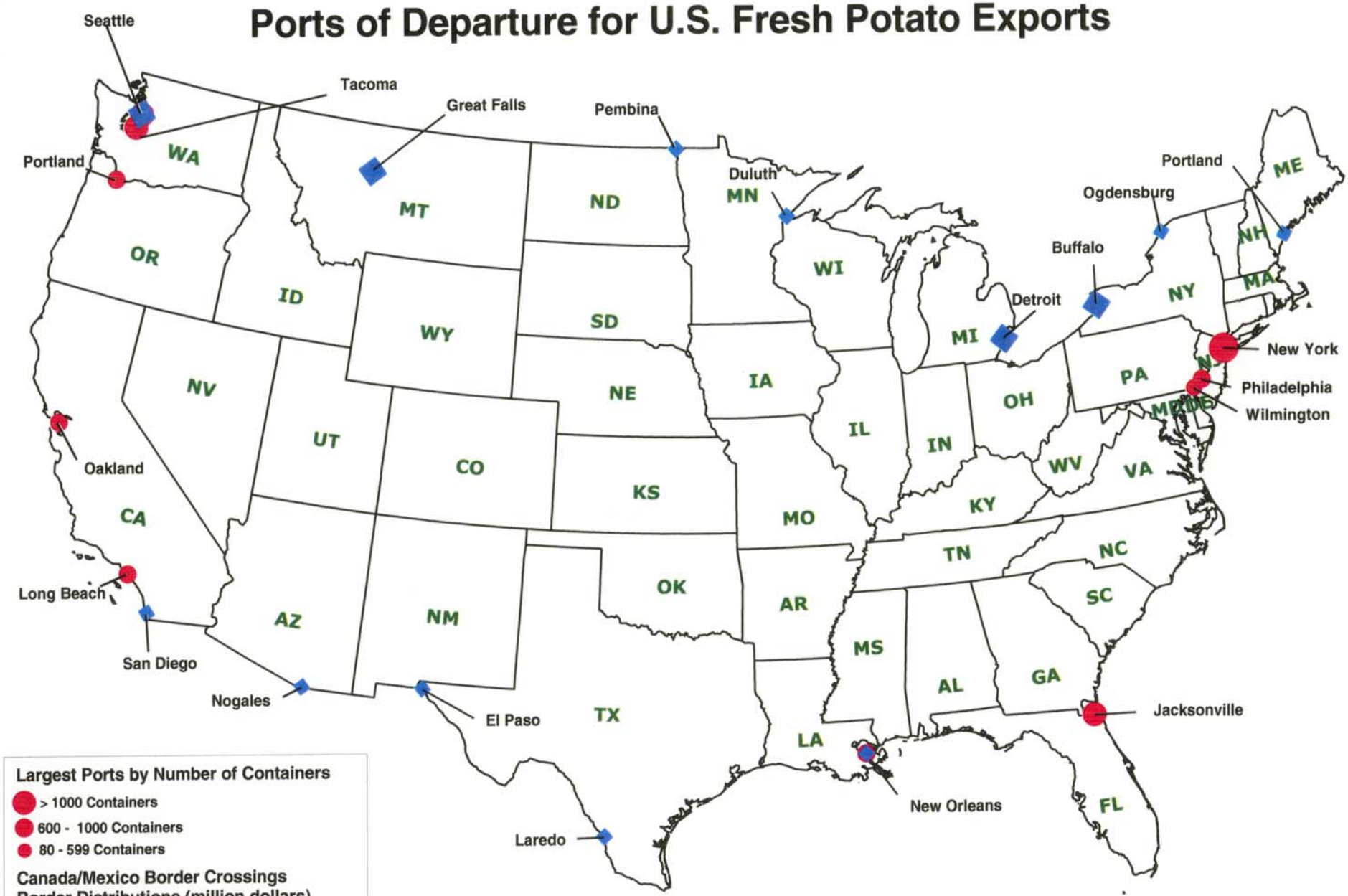
Domestic Potato Processors



Domestic Potato Processors



Ports of Departure for U.S. Fresh Potato Exports



Source: USDA/FAS and PIERS

Livestock, Poultry and Dairy Transportation

The following slides show production, consumption, and surplus/deficit maps for broilers, beef, pork, dairy cattle and milk.

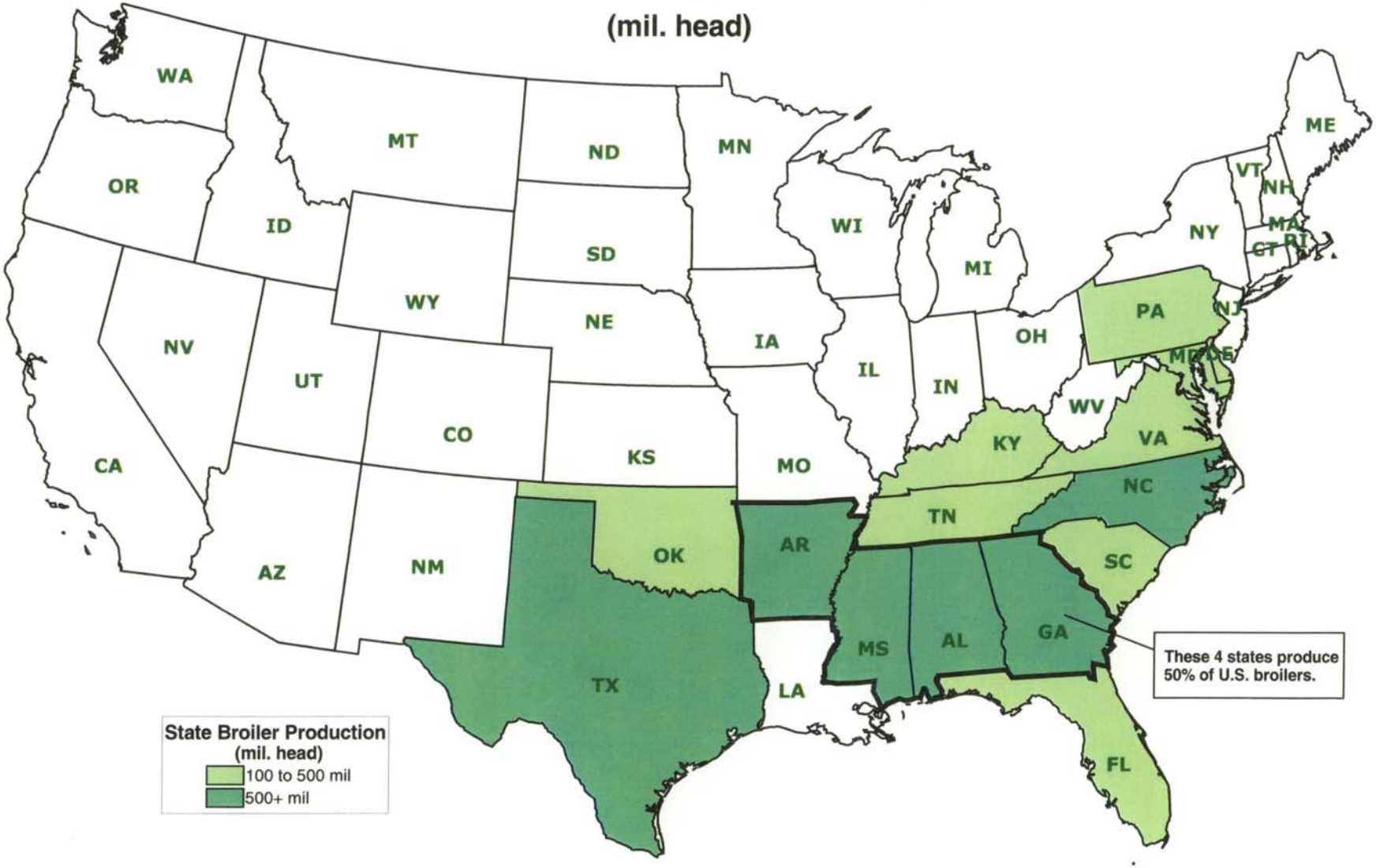
Maps also show by what mode of transportation the commodities move.

Broiler Facts

- A broiler is a young chicken, 6-8 weeks old.
- U.S. produced 8.4 billion broilers in 2001.
- Georgia produced the most broilers in 2001 at 6.2 billion pounds.
- California consumed the most broilers in 2001 at 2.7 billion pounds.

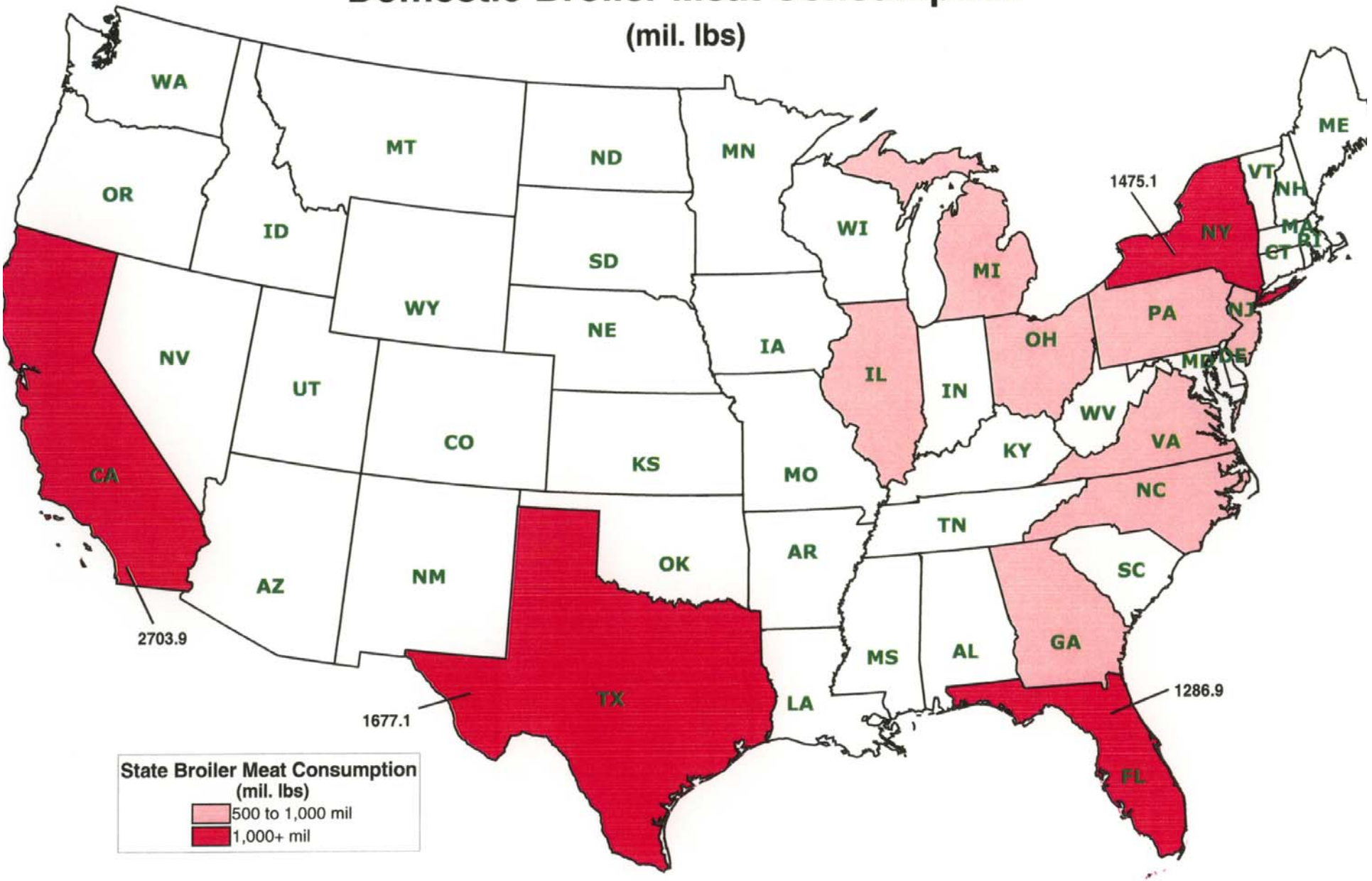
Domestic Broiler Production

(mil. head)



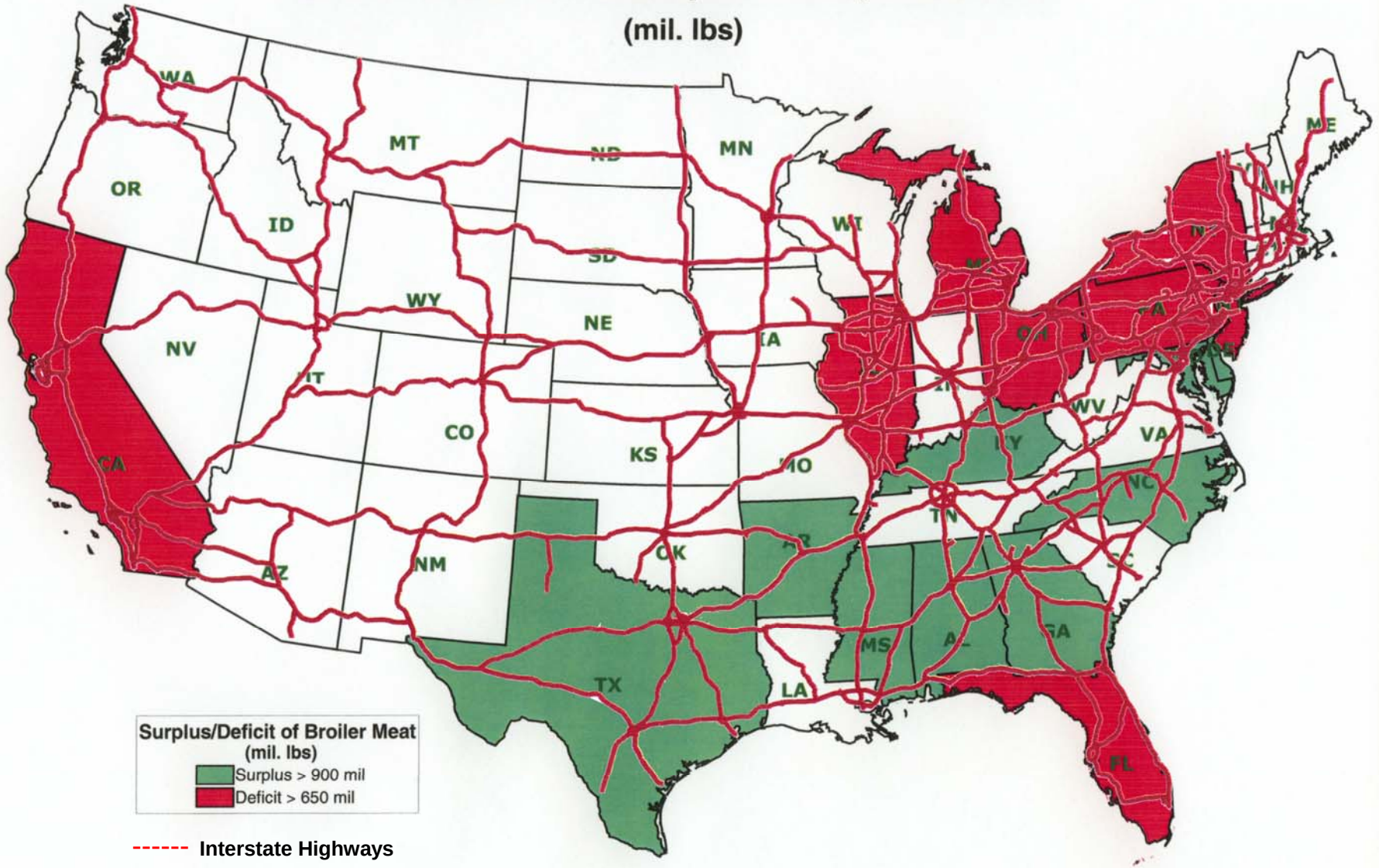
Domestic Broiler Meat Consumption

(mil. lbs)

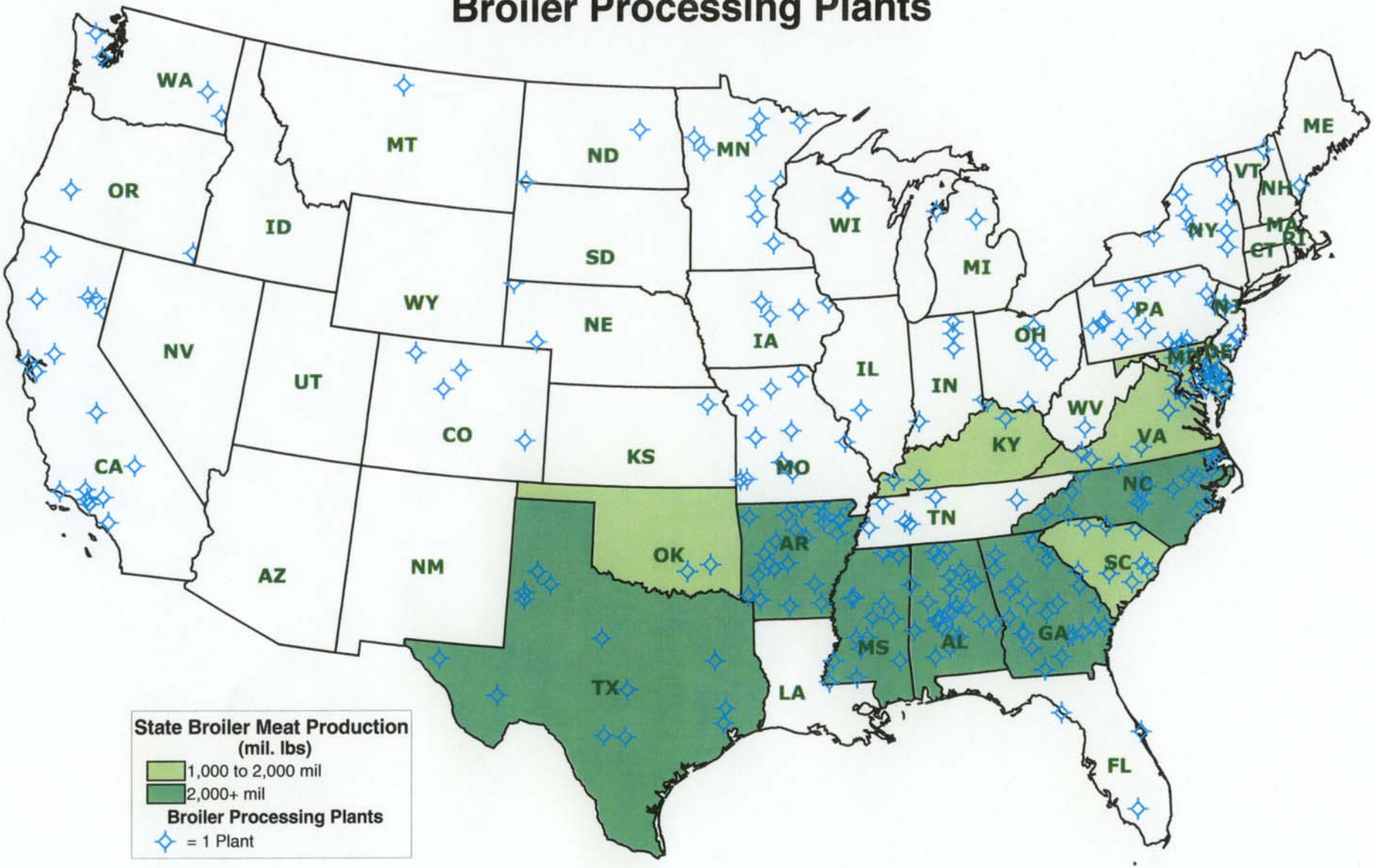


Broiler Meat Consumption Surplus/Deficit

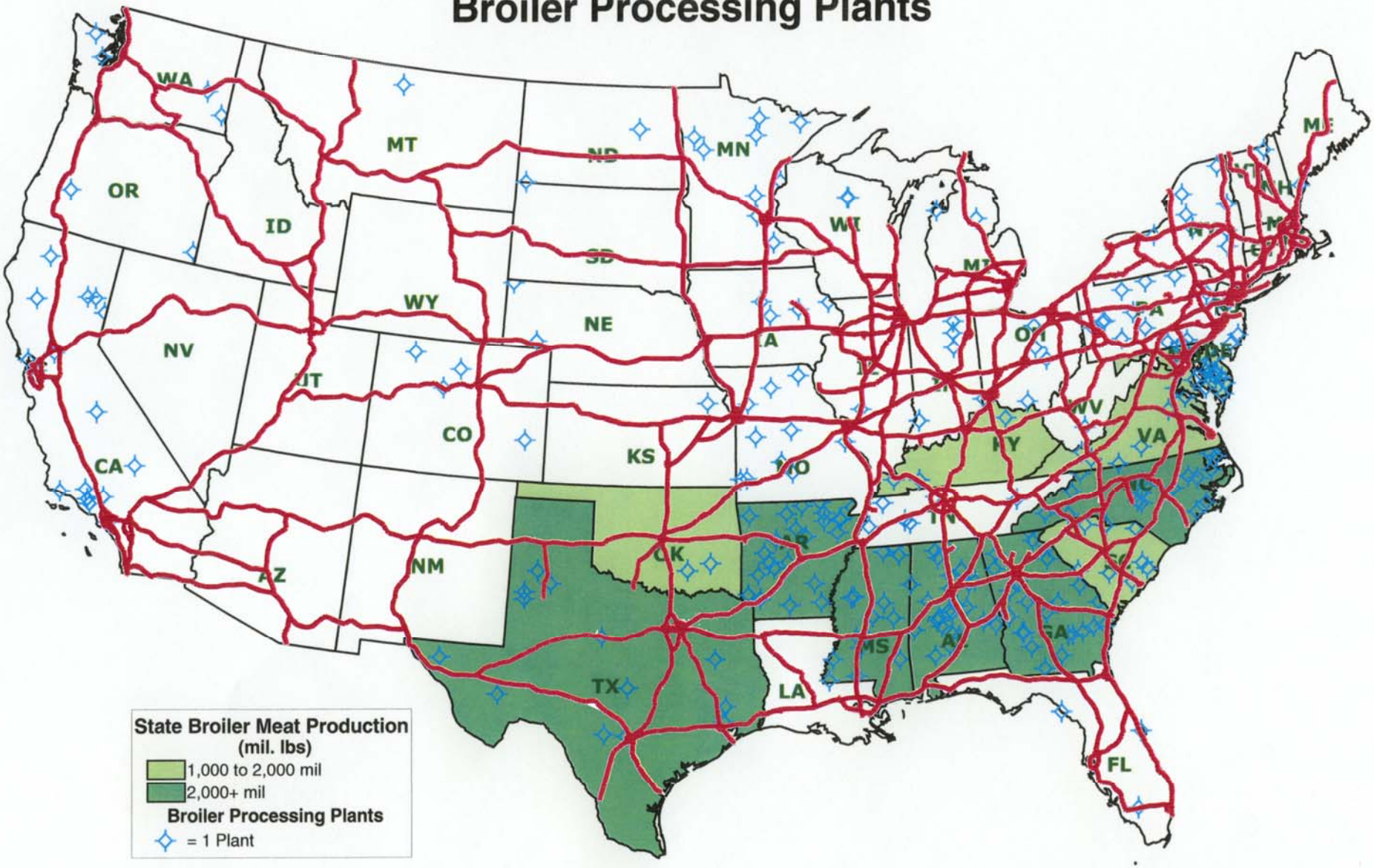
(mil. lbs)



Broiler Processing Plants



Broiler Processing Plants

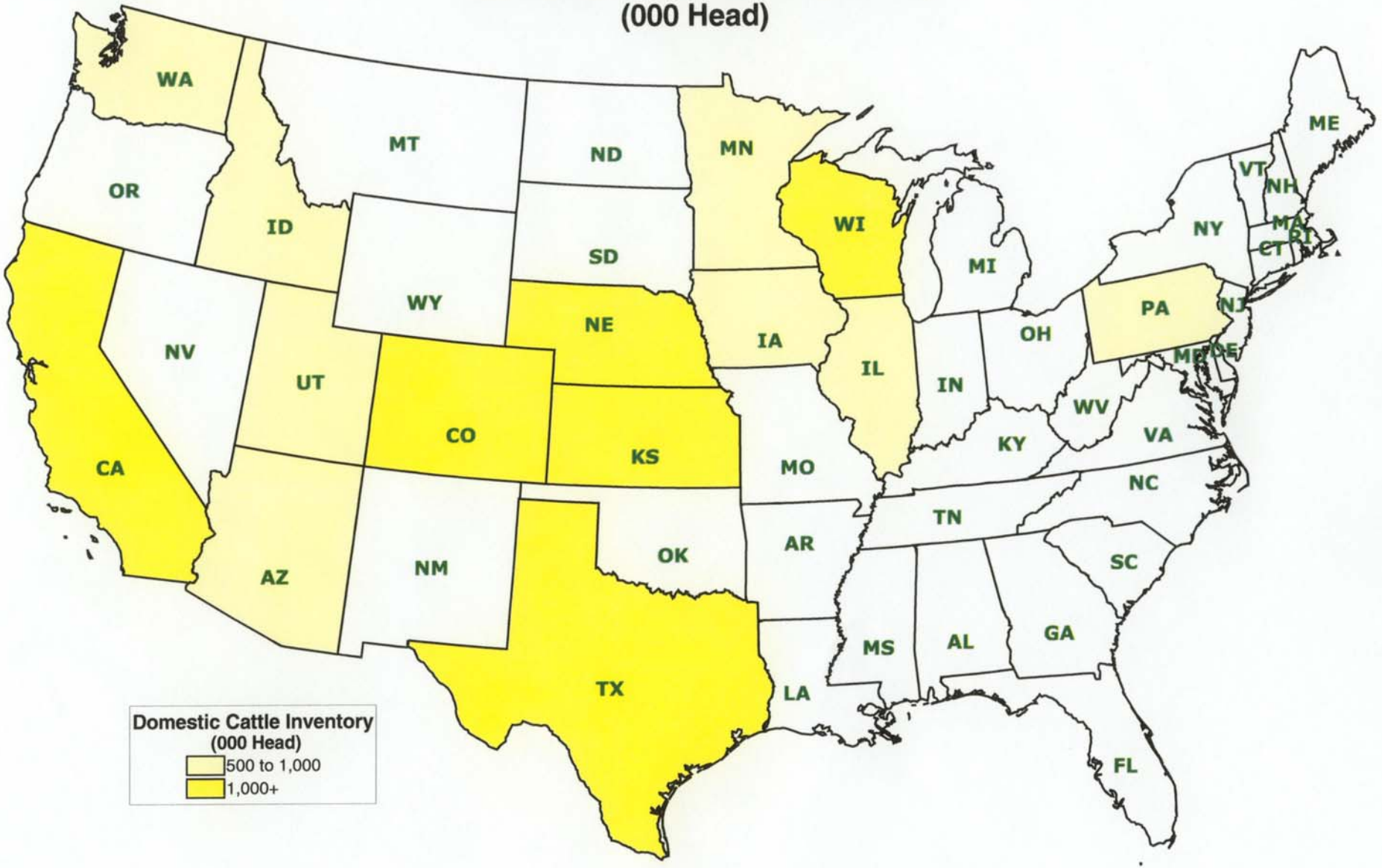


------ **Interstate Highways**

Beef Facts

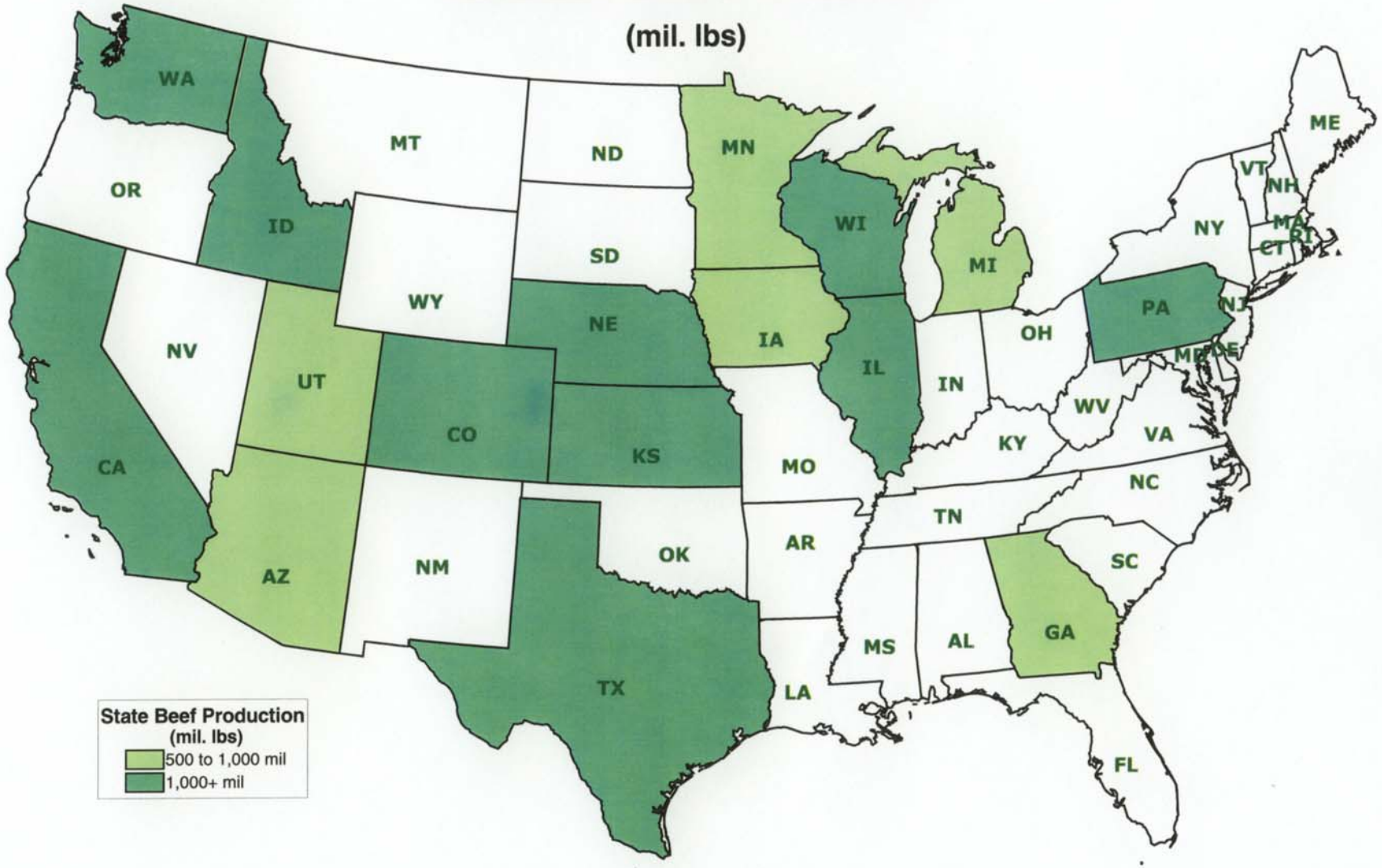
- U.S. is world's largest producer of beef.
- At the end of 2001, U.S. beef cattle inventory was at 33.1 million head.
- Beef cattle outnumber humans in 9 States: Idaho, Iowa, Kansas, Montana, Nebraska, North Dakota, South Dakota, Oklahoma, and Wyoming.
- Small farms produce the majority of beef cattle in the U.S. and control 74% of the land dedicated to beef production.
- Per capita consumption of beef in the U.S. is 66 pounds.
- In 2001, 9% of U.S. fresh/frozen beef production was exported.
- Primary customers for U.S. beef: Japan, Mexico, South Korea, and Canada.

Domestic Cattle Inventory
(000 Head)

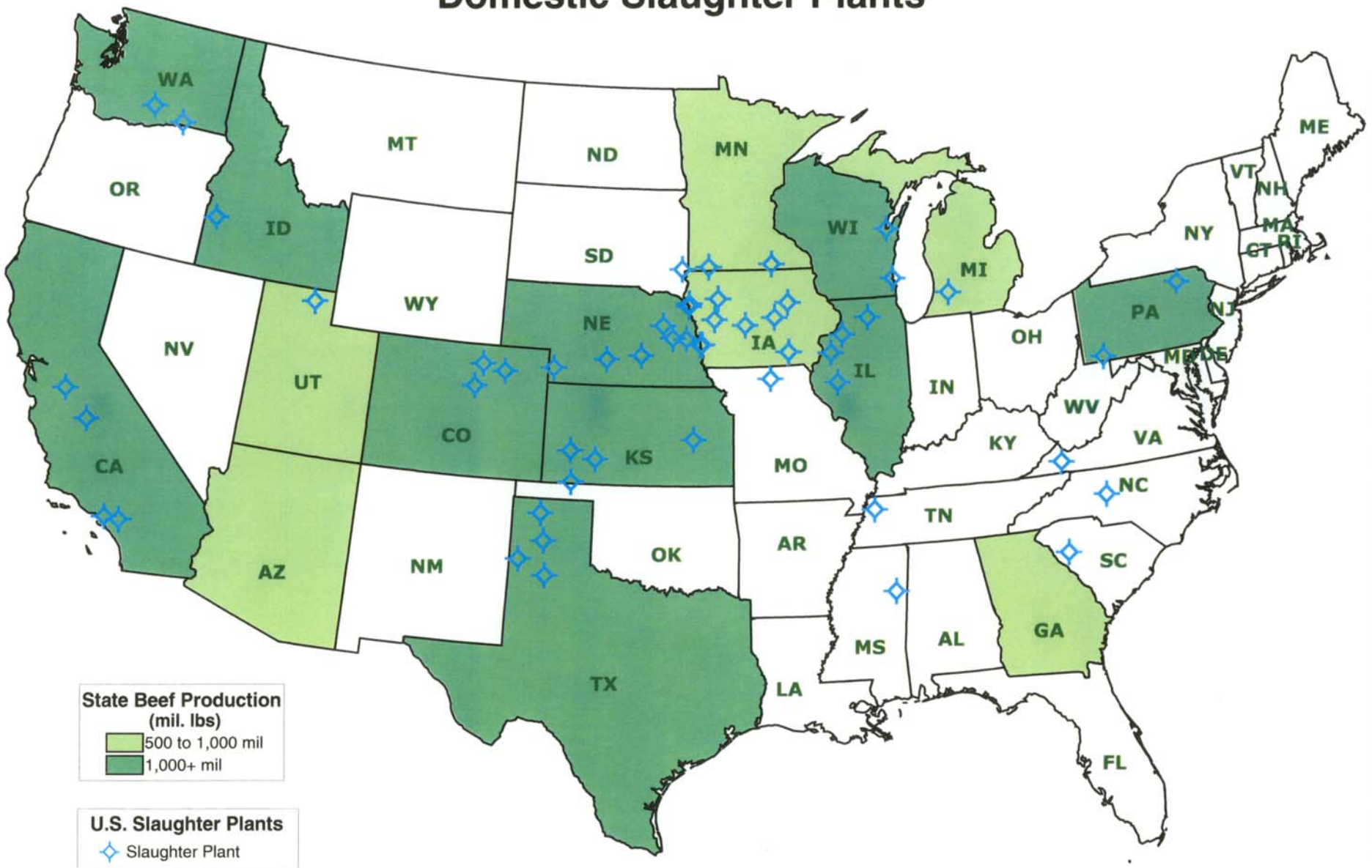


Domestic Beef Production

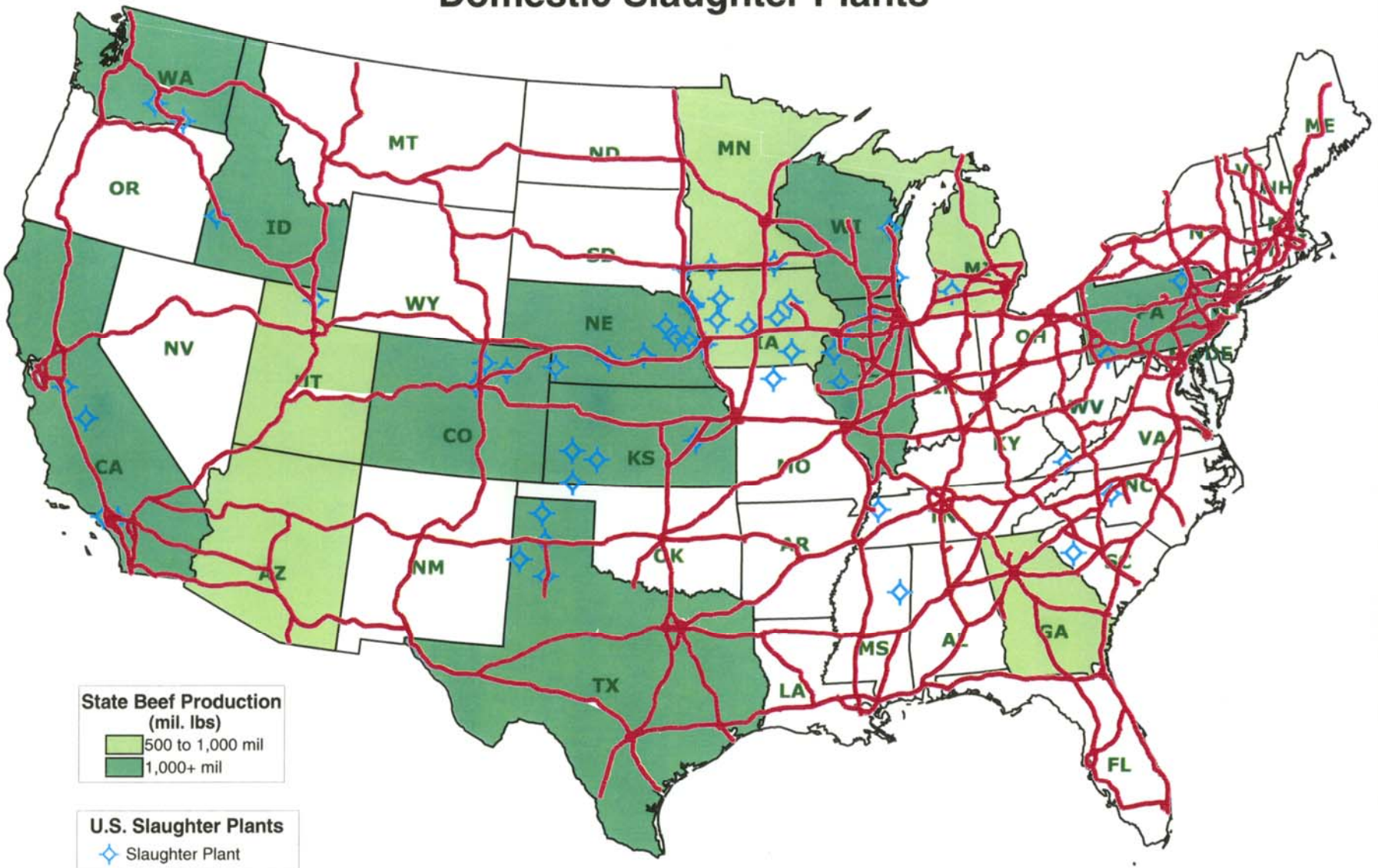
(mil. lbs)



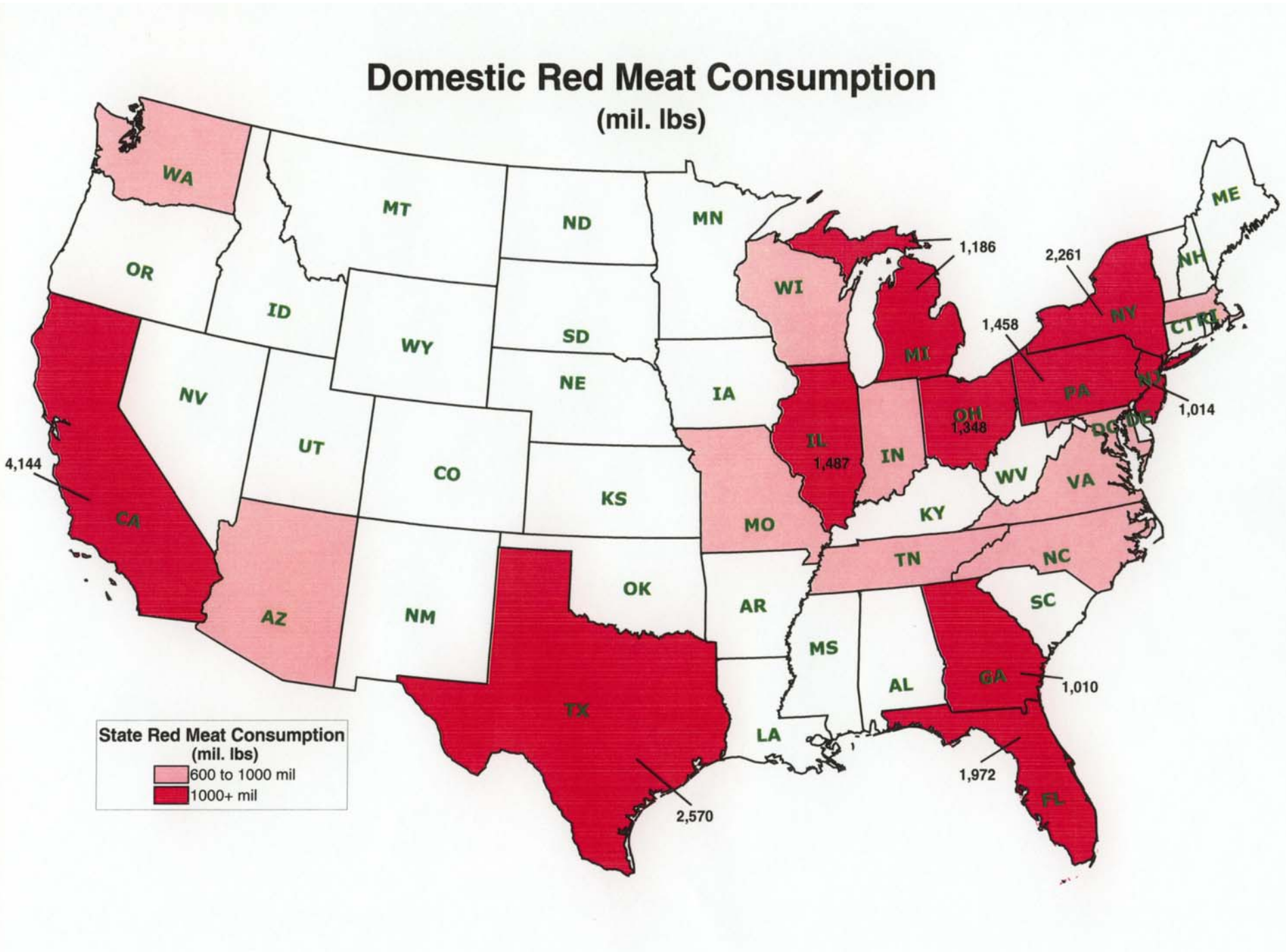
Domestic Slaughter Plants



Domestic Slaughter Plants



------ **Interstate Highways**


Domestic Red Meat Consumption
(mil. lbs)
WA
OR
CA
4,144
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
2,570
MN
IA
MO
AR
LA
WI
IL
1,487
MI
1,186
IN
OH
1,348
KY
TN
MS
AL
GA
1,010
FL
1,972
SC
NC
VA
WV
PA
1,458
NY
2,261
MD
DE
NJ
1,014
CT
RI
NH
ME
State Red Meat Consumption
(mil. lbs)
600 to 1000 mil
1000+ mil

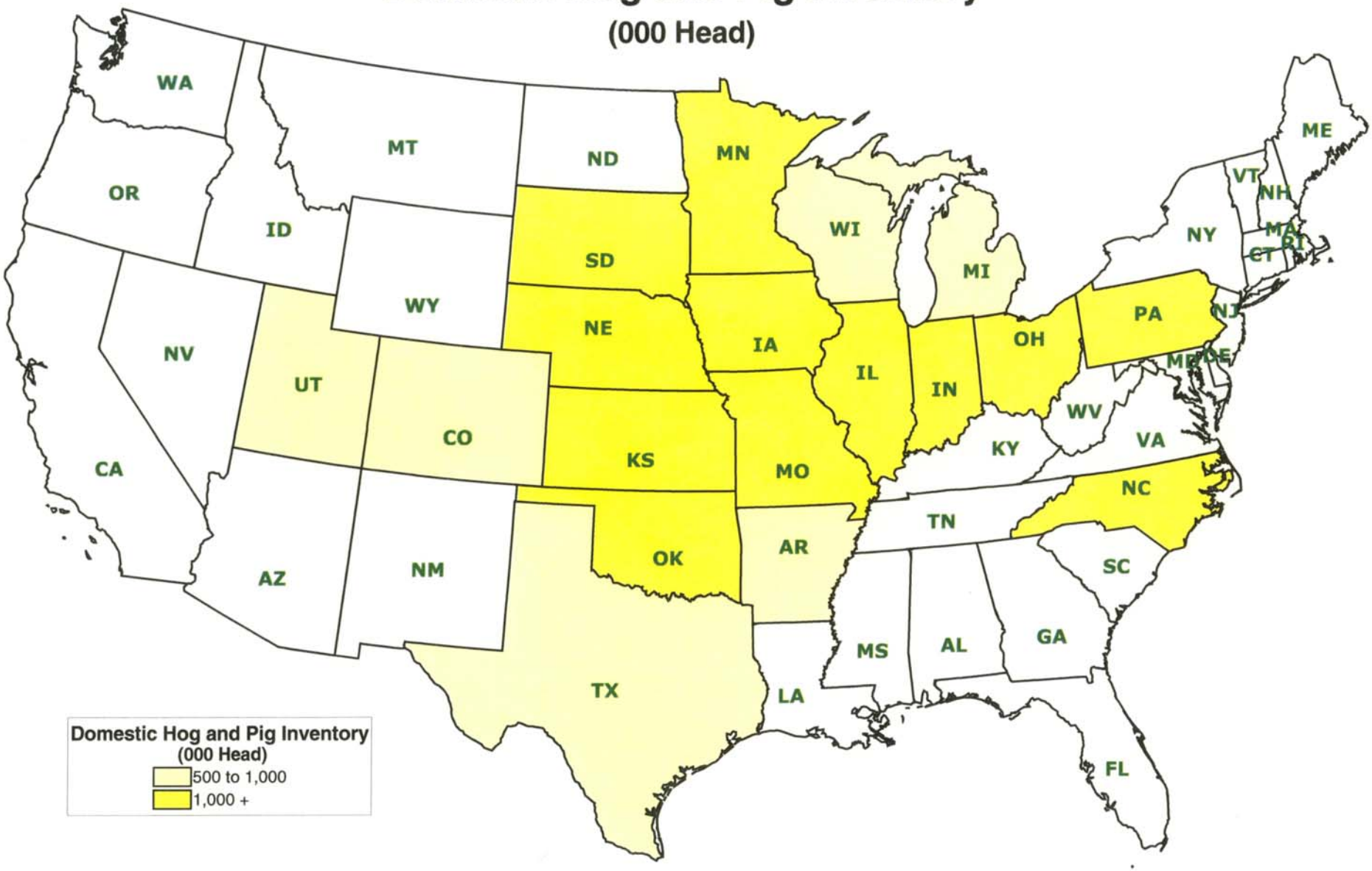
Ports of Departure for U.S. Fresh/Frozen Beef Exports

Pork Facts

- In 2001, the U.S. hog and pig inventory was at nearly 60 million head.
- About 68% was produced in the Midwest and 20% in the Southeast.
- In 2001, pork production totaled 19.2 billion pounds.
- In 2001, 8% of U.S. fresh/frozen pork production, nearly 1.6 billion pounds, was exported.
- Primary customers for U.S. pork: Japan, Mexico, Canada, and Russia.

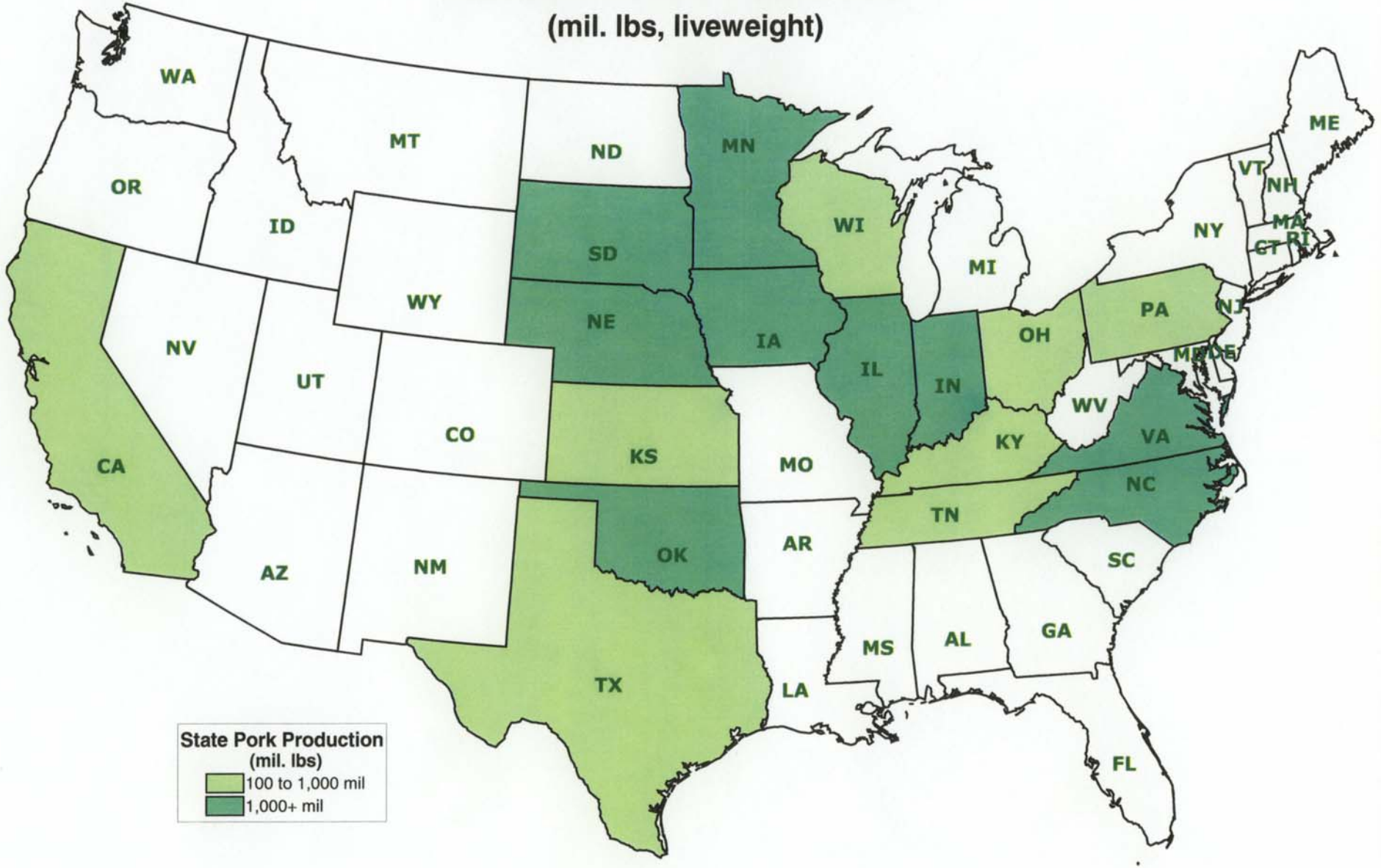
Domestic Hog and Pig Inventory

(000 Head)

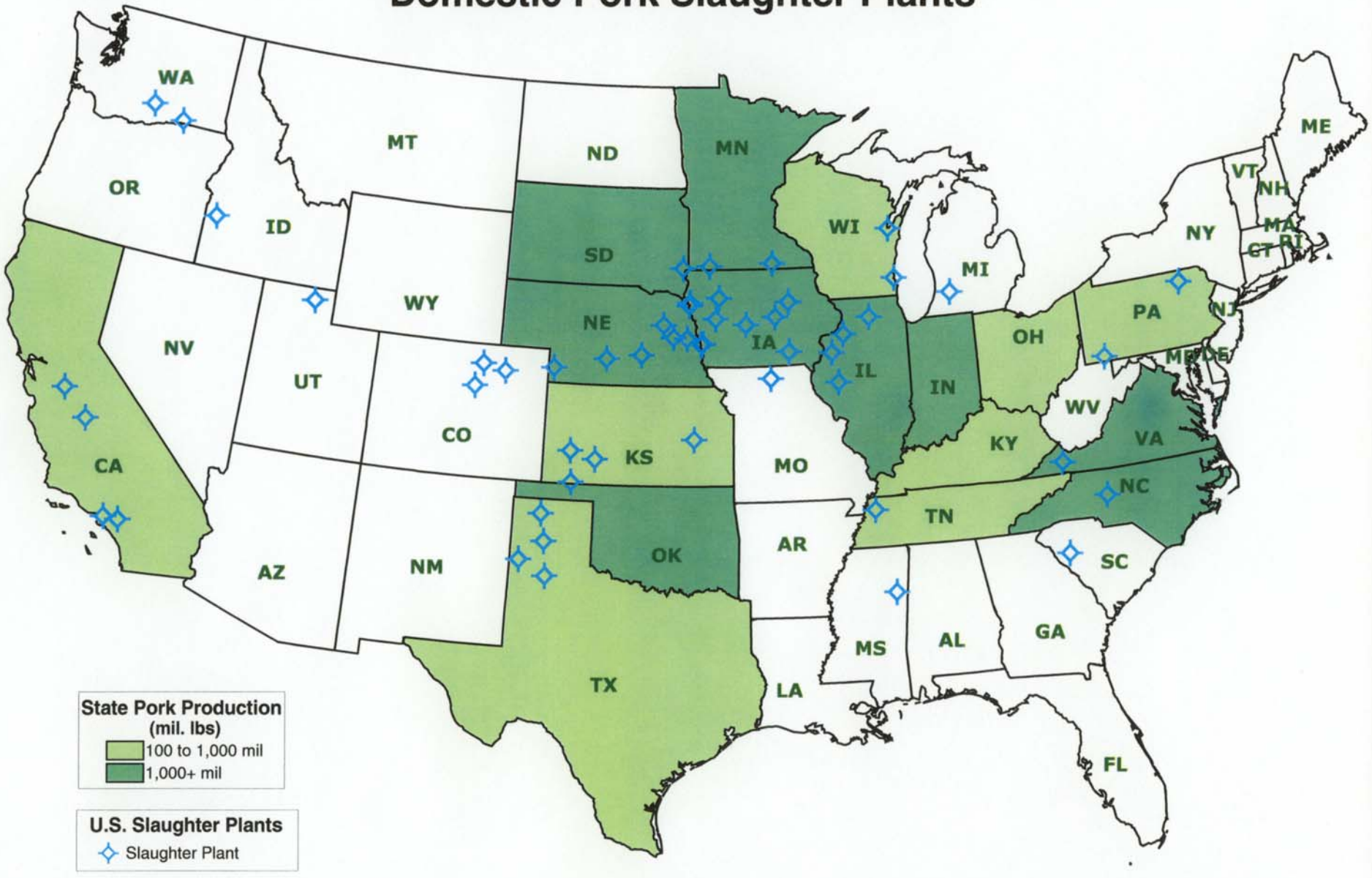


Domestic Pork Production

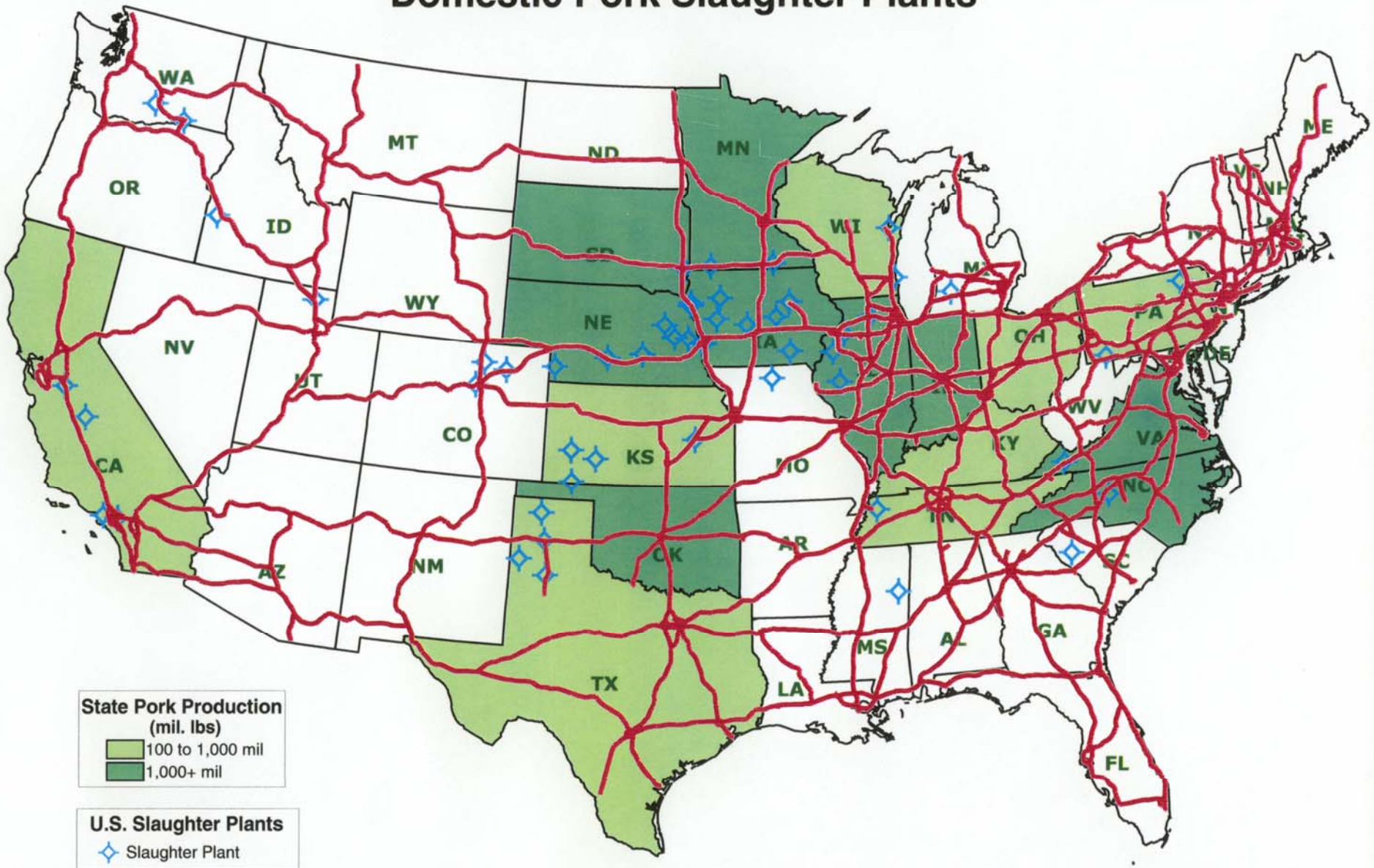
(mil. lbs, liveweight)



Domestic Pork Slaughter Plants



Domestic Pork Slaughter Plants



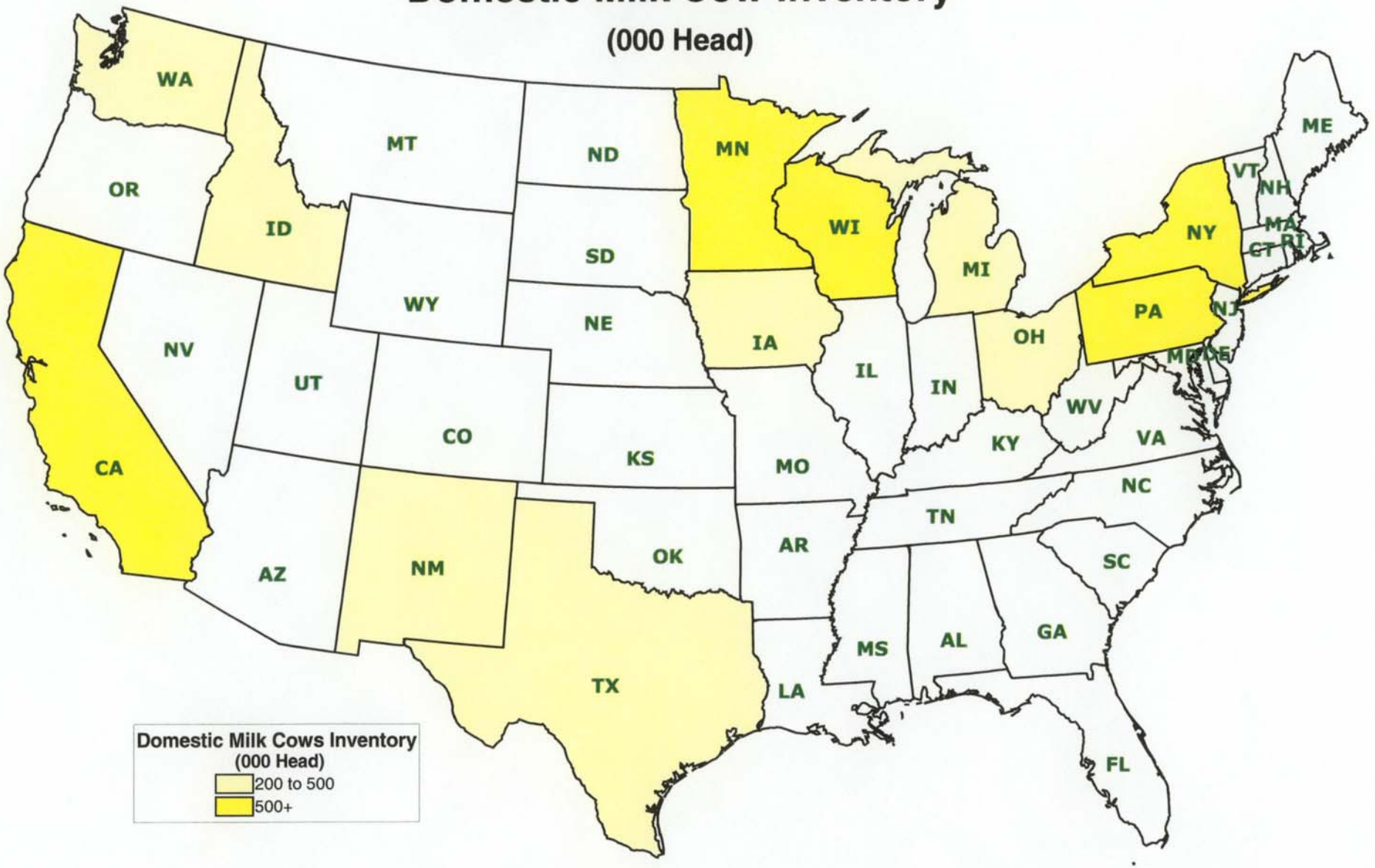
Ports of Departure for U.S. Fresh/Frozen Pork Exports

Dairy Facts

- California had the highest number of dairy cows in 2001: nearly 1.6 million.
- Alaska had the fewest dairy cows with just over 1,000.
- The average per capita milk production is 581 pounds.
- 6 of the top 10 States in total production are also in the top 10 in per capita production: California, Idaho, Minnesota, New Mexico, Washington, and Wisconsin.

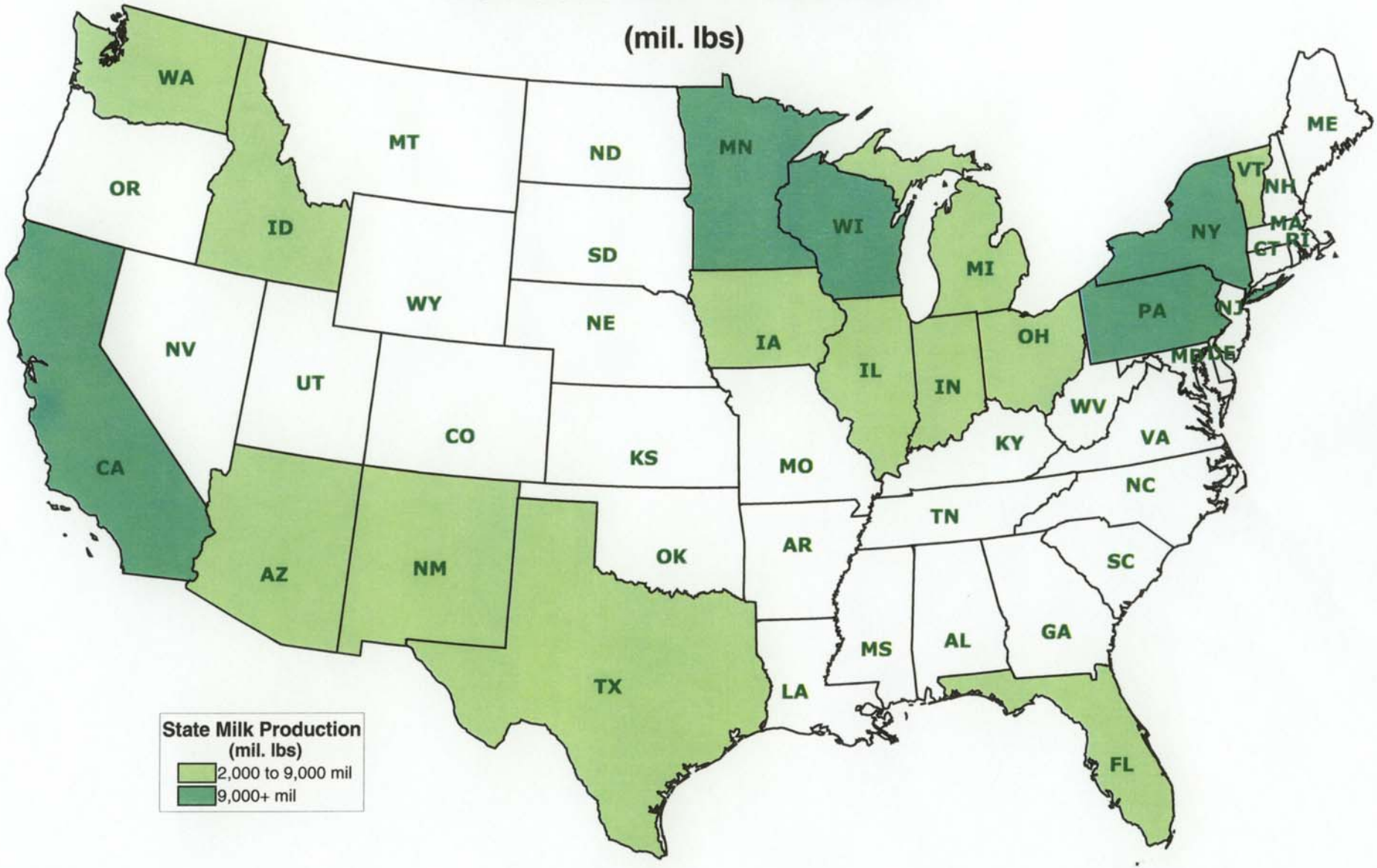
Domestic Milk Cow Inventory

(000 Head)



Domestic Milk Production

(mil. lbs)



Per Capita Milk Production

(lbs)